

A STUDY OF ARTERIAL BLOOD PRESSURE
AND HYPERTENSION IN BENIN CITY

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ABSTRACT

A review of the blood pressures in different populations shows that the blood pressure of the black African rises with age and that hypertension is not uncommon in the black African. Hypertension is more common and the consequences more severe in the black American than his white counterpart.

In cross-sectional surveys of two defined populations in the Bendel State of Nigeria — one rural, the other urban — 1482 males and 600 females were examined in the rural population and 916 males and 347 females in the urban population.

A rise in blood pressure with age was found in both sexes in all the subjects examined in both populations.

The mean systolic and diastolic blood pressure in all the subjects examined in Benin City (urban) were generally higher than those in Isiuwa village (rural).

The prevalence of hypertension was 7.1% and 3.0% for males and females respectively in Isiuwa village whilst it was 14.4% and 10.4% for males and females in Benin City. Re-examination substantially reduced the number of hypertensives.

The rural office clerks had higher mean blood pressures than the rural field labourers whilst the urban office clerks had higher mean blood pressures than the rural office clerks. The differences in mean blood pressures were statistically significant in certain age groups. Relative weight, literacy, ethnic origin, urinalysis and smoking did not explain the differences found in the mean blood pressures of rural field labourers, rural clerks and urban clerks.

The consistently intermediate values for rural clerks over the different age groups provide strong indirect evidence that both the influence of occupation and the area of residence were relevant to blood pressure.

Problems encountered in the management of hypertension in the follow-up study have been discussed and concrete suggestions for their solution in Nigeria have been presented.

CHAPTER 1

INTRODUCTION

High blood pressure is an important cause of morbidity and mortality in adult African hospital patients. Hypertensive heart disease is the most common type of cardiac disease in patients in Nigeria (Laukner et al. 1961, Parry and Ikeme, 1966; Carlisle and Ogunlesi, 1972; Oviasu 1973) and Ghana (Pobee et al. 1975) and in those of Bantu stock of South Africa (Schrire, 1964); it is also the fourth most common cause of heart disease in Uganda (D'Arbela et al., 1966) and Ethiopia (Parry and Gordon, 1968), after valvular, cardiomyopathic and infectious (e.g. syphilis, tuberculosis) categories. Hypertension is the commonest predisposing condition found in patients who suffer cerebrovascular accidents in Nigeria (Osuntokun et al. 1969; Dada et al. 1969).

Although the role of high blood pressure in causing morbidity and mortality in Nigeria has been recognized, there are few known community studies of arterial blood pressures in Nigeria, and those reports that are available, notably those of Abrahams et al. (1960), Akinkugbe and Ojo (1969), and Johnson (1971), have been reported from the former Western region of Nigeria where the inhabitants are the Yoruba tribe. In the Bendel State of Nigeria (capital, Benin City) where people of different ethnic origins live, no work has been done to determine the pattern of arterial blood pressure and the prevalence of hypertension in any selected population. Variations between rural and urban blood pressure distributions can be studied to learn

more about the aetiology of hypertension since the environment and physical activities of residents are different. Although differences in mean arterial pressures have been reported in a rural and an urban population in Nigeria (Akinkugbe and Ojo, 1969) and also from the West Indies (Miall et al., 1962) the reasons for such differences are not known. No work has been done in the African to find out if there are variations in the blood pressures of men engaged in strenuous physical activities such as field labourers and sedentary workers such as office clerks.

If differences could be found in the blood pressures of men engaged in occupations involving strenuous physical activity and men engaged in sedentary occupations then it is possible that influence of occupation might partly explain the differences in blood pressures previously reported in urban and rural subjects. It is therefore the aim of this study:-

1. To find the distribution of blood pressures and the prevalence of hypertension in all the subjects aged 15 to 60 years in a rural Nigerian village (Isiuwa village).
2. To find if there are differences in the mean blood pressures of office clerks and field labourers resident in Isiuwa village.
3. To find the distribution of blood pressures and the prevalence of hypertension in a group of urban residents who constitute the clerical workforce of the civil service in Benin City.
4. To compare the blood pressure findings among the subjects in the village with those of the City.

5. To refer the subjects found hypertensive from both surveys to a special clinic in the University of Benin Teaching Hospital and to report on some clinical aspects of hypertension and the problems encountered in their management and follow up.

CHAPTER 2

BENIN CITY — GENERAL BACKGROUND

It is important to describe briefly the historical, geographical, environmental, and cultural factors which affect the inhabitants of the area to be studied.

Benin City, capital city of Bendel State of Nigeria, is a city of ancient fame. Its fame rested on its art treasures (many of which now adorn the galleries of European capitals) and on its being the capital of an ancient Benin Kingdom known to be one of the oldest and most stable of the larger political entities in the forest zone of West Africa. It has a well established king-list of some thirty-seven rulers (Egharevba, 1960, Bradbury, 1957, 1973). The ancient Benin Kingdom is regarded as being coterminous with the present-day Benin Division, the unit over which the authority of the Oba (King) was recognised after the restoration in 1914. Benin City is called Edo by its inhabitants and individuals from all parts of the Kingdom refer to themselves and also to their language as Edo. "Benin" is a non-Edo word of doubtful origin.

The total area of Benin Division is about 4,000 square miles. The ancient Benin Kingdom extended as far as Onitsha on the bank of river Niger, Owo to the West and as far as Warri on the coast. The Oba (King) occupied the central position in the Kingdom. He was both divine and mortal, and was seen as the temporal and spiritual guardian of his people. His person was surrounded with mystery and was credited with all kinds of magical powers. He exercised his authority through the Council of Chiefs but he was at the same time a supreme and despotic ruler.

At various times between 1485 and 1897 (Ryder, 1969) European adventures, traders and missionaries made contacts with Benin City. In November 1896 the Acting Consul-General Phillips who was resident in Lagos, had sought permission of Lord Salisbury the Foreign Secretary "to visit Benin City in February next to depose and remove the king of Benin, and to establish a Native Council in his place and take such further steps for opening up the country as occasion may require". (Public Records Office F.O.2/102, 1896). Lord Salisbury refused permission for the proposed trip and advised caution. In 1897 a party of the British leading a delegation to Oba Ovonramwen, the king of Benin, had been warned not to come to Benin at the time because the Oba was in the midst of celebrating an important festival. The party did not heed the advice and proceeded nonetheless. Benin security forces guarding the approaches to Benin City massacred all members of the British party except one. In March 1897 a retaliatory British military expedition, after a fierce battle, took possession of Benin City. In the following September Oba Ovonramwen, the thirty-fifth king of Benin, was deported to Calabar. Thus ended the independence of what had been one of the largest and longest lived of the West African forest states.

A British Resident was installed and colonial rule was established in Benin City. In 1914 the territory known as Nigeria was established by the unification of the protectorates of Southern and Northern Nigeria. It was, however, not the end of kingship in Benin City, for when Ovonramwen died in exile in 1914, his son Aigubasimwin was made king by the British.

In the early years of British rule many of the gifted sons and daughters of Benin left for other towns, particularly the capital city of Lagos, to seek and make their fortunes. Although Benin suffered a decline during the early years of British rule, it was also the beginning of the introduction of progressive measures. Schools and health centres were opened and the relative isolation in which the inhabitants of Benin City had lived gave way to modern influences.

The fortunes and prestige of Benin were rejuvenated with the creation of the Mid-West Region in 1963. This event made the Mid-West the 4th region in Nigeria in a federal system of government and Benin again became a principal city. This event is of importance to this study since it was the same instrument which gave the Mid-West its autonomy and converted Benin to its principal city that made it necessary to set up the University of Benin and the University of Benin Teaching Hospital.

In 1967 just before the Nigerian Civil war (1967-1970) the four regions of Nigeria were subdivided into 12 states. The boundaries of Midwest Region were unaffected by the exercise. Again in 1975 it became necessary to further divide Nigeria into 19 federal states for political and administrative convenience. The boundaries of Midwest Region were again left intact but the name 'Midwest Region' was changed to Bendel State, with Benin City as its capital. The name 'Bendel' is derived from Benin and Delta. The Delta area of Bendel State is the swampy coastal part of Bendel, inhabited by the Urhobo, Isoko and Itsekiri.

Today Benin is a rapidly developing City confronted in its wake by industrialisation and urbanisation.

Urbanisation is characterised in most cases, by a transformation of traditional society in its ideas, value systems, social and family structures. Every where there are signs that the city is fully awake. The traffic is heavy, the streets are narrow, traders with their wares are to be seen in their stalls and on the pavements on both sides of the roads. The people one finds are mostly young and wear brightly coloured prints in that peculiarly African style. There is a lot of noise but no one appears to care. It is part of the daily scene in Benin City.

Benin City is divided into two halves by a broad street. In one half (Ogbe) live the Oba (King) and his court and the palace chiefs and in the other the town chiefs. There is another part of the town, the European quarter, now renamed Government Reservation Area. In the colonial days, government officials lived here, the houses are cleaner, the streets tarred, and there is a golf course. The Europeans are no longer in the majority here. Africans have taken over their places, the golf course and club house. The area is quiet and there does not appear to have been much change except that black people have taken over where there used to be white.

Demographic Status

There have been some difficulties of a political nature in getting accurate census data for Nigeria. Population figures are available for 1963, the year of the last census. A figure of 2,535,839 was given for the Bendel State. This was distributed amongst the 10 administrative divisions as follows: Afemai 225,922, Akoko-Edo 112,185, Asaba 315,998, Benin 429,907, Ishan 270,903, Aboh 178,154, Western Ijaw 231,746, Isoko 491,736, Warri 145,060.

There are more young people than there are old. The mean age is 21.6 years (SD 13.5). 47% of the population are under 20 years, a comparative figure for England and Wales is 31.3%.

The majority of the population live in rural areas. The ratio of people living in rural areas compared with those in urban areas (2,189,243 to 346,596) is a ratio of approximately 6.3 to 1. Many young people are now leaving the rural areas to seek the glitter and opportunities of city life.

The population of Benin Division is 429,907 of which 100,694 live in Benin City and 329,213 live in rural areas. The rural areas of Benin Division consist of several hundred compact village settlements ranging in size from 20 or 30 to more than 4,000 inhabitants, 13 between 2,000 and 4,000, 49 between 1,000 and 2,000 and 571 less than 1,000.

The distribution of the population over 14 years of age for Benin Division, both urban and rural, is shown in Table 1. The male/female ratio is 137,256 to 113,395 that is a ratio of 100 to 83. The total labour force was estimated at 130,515.

Geographical Notes

The total area of Bendel State is about 14,922 square miles of which Benin Division is about 4,000 square miles. The Niger delta is an area of shifting sand banks and dense mangrove forests. Benin Division is a low-lying plain covered with porous sand, and rising to the north is the Ishan plateau. There are no outstanding physical features and no solid rocks near the surface. The area is drained by a series of deeply entrenched rivers and small streams flowing in a general north-south direction.

The natural vegetation of the area is high tropical rain forest with a good deal of swamp vegetation.

The average rainfall is about 80 inches and the relative humidity varies between 69° to 96° , while the mean daily temperature varies between 71° and 87° .

The climate is generally regarded as unhealthy especially as the swamp provides good breeding grounds for mosquitoes. The swampy nature of the land has made it difficult to construct an adequate network of roads so that communication with the hinterland is generally poor. Benin Division is important for timber and rubber production, which has become a major cash crop.

TABLE 0.1

THE POPULATION OF BENIN DIVISION OVER 15 YEARS

	MALES	FEMALES	TOTAL
15-19	19,754	11,428	31,182
20-24	29,720	27,746	57,466
25-34	40,295	37,446	77,741
35-44	22,044	17,888	39,932
45-54	12,319	9,154	21,473
55-64	6,307	4,822	11,129
65-74	3,436	2,527	5,963
75 +	3,381	2,384	5,763
TOTAL	137,256	113,395	250,651

Language and Religion of the People

The divisions of Bendel State are based on linguistic affinity but there is considerable degree of overlap in several areas. The people from Benin division speak Edo, the people from Ishan speak Ishan which is a dialect of Edo. The people of Akoko-Edo speak a language which is a mixture of Yoruba language and a local dialect. The people from Asaba speak Ibo. The people from Urhobo division speak Urhobo. The people of Warri speak Itsekiri which is a language similar to Yoruba.

The people of the Benin Kingdom believe in a high god, Osanobua, the creator of all things and beings. They think of the universe as consisting of the visible world and the invisible abode of numerous deities, spirits and supernatural powers. The Christian and Moslem religions have made considerable inroads among the Edo speaking people. But many people still cling to their ancient faith in gods such as Olokun the goddess of fertility, Ogun the god of Iron, Sango the god of thunder. Among the Afemai, Akoko-Edo, and to a lesser extent Ishan, the moslem religion is practised.

The foods of Edo speaking people consist of high carbohydrate diet supplemented by meat protein from wild game and cattle transported from the Northern States of Nigeria. Fish is largely obtained from the riverine and swampy coastal part of Bendel. Lots of vegetables are available but they are usually heavily cooked before being consumed. Palm oil is the cooking oil used in almost all forms of cooking. Salt in moderate quantity is added to all forms of cooking.

CHAPTER 3

HISTORICAL AND EPIDEMIOLOGICAL SURVEY OF BLOOD PRESSURE IN THE BLACK RACE

Introduction:

There are numerous difficulties in the review of the literature available on studies of blood pressure of the African. Close comparisons are made difficult by the lack of proper definition of hypertension, wide variation in selection of population and the lack of uniform procedure in the measurement of blood pressure. In spite of the drawbacks arising from definition, sample selection and procedure, a picture of the blood pressure of the black African has emerged.

Information available on blood pressure in the African appears to be one of the following types:

- (i) Pattern of blood pressure in populations
- (ii) Prevalence of hypertension in selected samples of populations
- (iii) Hypertension as a risk of morbidity
- (iv) Hypertension as a risk of mortality.

Early reports of surveys of arterial blood pressure in Africa indicated that high blood pressure was uncommon in the black African (Donnison, 1929; Vint, 1937). Later, reports showed that high blood pressure is, at least as common in Africans as it is in Caucasians.

For clarity, the literature on blood pressure in the black African is here reviewed under the headings of different regional divisions of Africa.

Africa South of the Sahara

(i) East Africa:

Donnison (1929) reported that during a two year period during which he saw 1,800 African patients from Kavirondo district on the shores of Lake Victoria in Tanzania, he did not encounter a single case of hypertension. He observed that the blood pressure of the African was related to age up to the age of 40 years in the same way as that of the Europeans; but after the age of 40 years the blood pressure of the African fell whilst that of the Europeans rose.

Williams (1941) reported on a group of Africans similar to but not identical with those reported earlier by Donnison (1929). He noted that in 456 Africans between the age of 21 and 50 years the rise of blood pressure with age was similar to that of the European; that after the age of 40 years the blood pressure did not fall. Later, however, Williams (1944) drew attention to the presence of both essential and renal hypertension in the African natives of Uganda. At a later date Williams (1954) reported that of 167 African patients admitted into Mulago hospital, Kampala, Uganda with cardiac disease, 32 had moderate hypertension.

Shaper and Saxton (1969) measured arterial pressures and body build in a rural community in the Kasangati area of Uganda. They found blood pressure patterns with age similar to those seen in Europeans.

Williams (1969) examined two rural communities in northern Kenya — the settled agro-based Kikuyu and the nomadic Samburu tribesmen.

He found that at all age levels and in both sexes, blood pressures rose with increase in age only in the Kikuyu.

The low blood pressures found in the Samburu tribesmen have been found capable of change from low to high. Shaper et al (1969) studied the Samburu tribesmen who joined the Kenyan army. From a diet consisting of milk, meat, and blood, the Samburu men had changed to a diet made up of about 53% carbohydrate, 20% protein, and 27% fat and their salt intake increased very considerably. The Samburu men showed a significant rise in systolic blood pressure after an average of two years. They had also gained weight.

Necropsy reports from East Africa in the 1930's indicated that hypertensive disease was rare. Jex - Blake (1934) reported no case of hypertension or hypertensive heart disease out of 1,100 post-mortems in Africans in Kenya. He attributed the only case of cerebral haemorrhage to syphilis.

Vint (1937) reviewed 1000 necropsies on Africans in Kenya and reported that he had not seen a case of hypertension.

From the 1940's post-mortem reports indicated that hypertension and its complications were not uncommon in the African. Davies (1948) in a report on the pathology of Central African Natives, found that hypertension was the commonest cause of congestive heart failure in the black African, accounting for over one third of all cardiac deaths.

Recent clinical reports on patients in Uganda emphasise the importance of hypertension as a cause of disease in the African. Leather (1958) in a report on 66 patients aged 5 to 75 years, noted that glomerulonephritis and pyelonephritis were

important causes of hypertension in the young African; but that after the age of 40 years, essential hypertension was more common. From Tanzania came reports that hypertension was an important cause of heart disease in the African (Cole 1959). Hutt and Coles (1969) in their report on 3000 necropsies done in Uganda over a three year period, found that 84 cases were finally diagnosed as hypertensive heart disease. Of these 84 cases, 25 cases were essential hypertension, 24 cases were hypertension associated with glomerulonephritis, 19 cases were hypertension associated with pyelonephritis while 11 cases were hypertension of uncertain origin.

D'Arbela et al. (1966) in a study on heart disease in Mulago hospital, Uganda, reported that hypertension was the fourth most common cause of heart disease in Uganda after valvular, cardiomyopathic and infectious categories.

More recently, the results of a survey for cardiovascular disease in middle-aged Ugandans showed that out of 412 middle-aged persons living at Kasangati, hypertension was the dominant cardiovascular disorder in 33.7 per cent of the study population (Ikeme et al. 1974). The most frequent complication of hypertension was cardiomegaly which occurred in 23.7 per cent of hypertensives.

(ii) Central Africa

Du Bois (1932) measured the blood pressures of 200 men aged between 20 and 55 years in Congo-Kinshasha and found that 71 men had systolic pressure of over 145 mm Hg.

Gelfand (1952) examined 255 African soldiers and found a systolic pressure of over 140 mm Hg. in 15 men and a diastolic

pressure of over 90 mm Hg. in 7 men. He also reported that during a period of 18 months during which 1500 patients were examined in his wards, 70 men were found to have a systolic pressure of over 140 mm Hg. whilst 101 men had a diastolic pressure of over 90 mm Hg.

Miller et al. (1962) examined 776 indigenous Africans at the Albert Schweitzer hospital near Lamberene in Gabon and found that 7.6 per cent had hypertension.

(iii) Southern Africa

Kaminer and Lutz (1960) measured the blood pressures of Kalahari bushmen and observed that in women, systolic and diastolic pressures were higher than in men, and that the pressures did not rise with advancing age. They also showed that blood pressure of the bushmen could change if the immediate environment changed. Kaminer and Lutz observed that the mean systolic and diastolic pressures of Kalahari bushmen who were working as farm labourers or who were in prison were higher than the pressures of their still nomadic brothers.

Heimann et al. (1929) found 18 cases of 'degenerative' heart disease including hypertension out of the 120 Africans studied. Ordman (1948) examined 1,522 Bantu subjects and found a rise of blood pressure with age and a high prevalence of hypertension. Schrire (1958) analysed 12,512 electrocardiograms of white and non-white subjects in Cape town and related his findings to the height of diastolic blood pressures. He found that hypertensive heart disease was more common in the non-white members of the community.

Becker (1946) reviewed 3,000 post-mortems done in Johannesburg between 1924 and 1938, and found that hypertensive heart disease was the second most common disease among the Bantu and coloured subjects of South Africa. Uys (1956) found 76 cases of "hypertensive nephrosclerosis" out of 3,707 consecutive autopsies done on the Bantu. Laurie and Woods (1958) found 18 cases of hypertension out of 31 cases of cerebral atherosclerosis in 300 autopsies done on the Bantu.

Scotch et al. (1961) examined 382 Zulu adults in an African housing estate and found that mean arterial pressures in both sexes and the prevalence of hypertension rose with age. Scotch (1963) found that Urban Zulus had significantly higher blood pressure than the rural Zulus.

(iv) West Africa

Shattuck (1930) reported from Liberia that hypertension was less common in the black African than in the American white. Sarkies (1953), however, drew attention to the high incidence of hypertension and primary glaucoma in the Africans in the Gold Coast (Ghana). Callender (1953) reported that 60 per cent of 400 Nigerian army recruits aged 19 to 24 years had a diastolic pressure of 90 mm. Hg. even after an hour's rest with sedation using sodium amytal.

Abrahams et al. (1960) examined 641 Nigerians all over 20 years of age in Ilora, a small town near Ibadan. They found that blood pressure rose with age in both sexes and that there was no clear relationship between blood pressure, weight, diet and climate. The observations of Abrahams et al. (1960) were taken further by Akinkugbe and Ojo (1969) who measured blood

pressures in a rural community at Eruwa village and in a sample of urban population at Ibadan. They found that systolic and diastolic blood pressures rose with age in both sexes in all age groups; and that blood pressure levels were similar in women from rural and urban areas, but seemed much higher in urban than in rural men. Johnson (1971) measured blood pressures in an urban African population sample in Lagos and found that the overall prevalence of hypertension was as common in females as in males. He also found that in both sexes the prevalence of hypertension rose with age. The surveys reported by Abrahams et al. (1960), Akinkugbe and Ojo (1969), Johnson (1971) were all done among the Yoruba speaking tribe in the former Western Region of Nigeria.

The report of Etta and Watson (1976) suggested that among the rural nomadic tribe in Northern Nigeria there was no consistent change of systolic blood pressure with age until the sixth decade.

Pobee et al. (1977) found that rural Ghanians had mean systolic and diastolic pressures which were lower at all ages than urban groups. They also found that 2.5 per cent of rural Ghanians aged 16 to 54 years had a diastolic pressure of 95 or higher mm Hg.

Clinical reports from Nigeria and Ghana point to the fact that hypertension is an important cause of morbidity and mortality. A review of 3,645 necropsies in Accra (1921-1953) by Edington (1954) attributed death to high blood pressure in 31 cases, of which 10 were renal in origin.

Binder (1961) reported that hypertension was the commonest cause of death among cardiovascular diseases in Ghana.

Lauckner et al. (1961), in a review of 1,384 medical admissions into the University College Hospital, Ibadan Nigeria in 1958, recorded 29 cases of hypertensive heart disease.

Smith (1966), and Akinkugbe (1969) have reported that essential hypertension has been found to be the most common form of hypertension encountered in the black African. Hypertensive cardiac disease has been found to be the most common type of cardiac disease in Nigeria (Carlisle and Ogunlesi, 1972) and in Ghana (Pobee et al. 1975).

Osuntokun et al. (1969) and Dada et al. (1969) reported from Ibadan and Lagos respectively that hypertension was the commonest predisposing factor most closely associated with development of cerebrovascular accidents in Nigerians.

HYPERTENSION IN WHITE AND BLACK RACES

(1) The United States of America

Prevalence of Hypertension

Hypertension has repeatedly been described by many observers as the major public health problem of Blacks in the United States (Stamler, 1973). Numerous reports in the 1930's indicated that the incidence of hypertension in the blacks was two and a half times that of whites (Adams 1932; Laws, 1933; Flaxman, 1934; Hedley, 1935; Schulze and Schwab, 1936).

Reports of the National Health Surveys (1964) confirm the higher incidence of hypertension in the blacks compared with whites of the United States.

The reports also indicate that both systolic and diastolic blood pressures rise with age. That in addition to age, the frequency distribution of blood pressure varies by sex and race. For example, a diastolic blood pressure of 90 mm Hg. and above are found in 14.7 per cent of white females and 16.7 per cent of white males. Corresponding percentages for blacks are 28.6 and 32.4.

The National Health Survey (1966) also reported that hypertensive heart disease is more frequent in blacks, both males and females, than in whites.

Factors Related to Hypertension

The prevalence of hypertension is known to depend on age, sex and race. Stamler et al. (1975), in both cross-sectional and prospective studies, evaluated the relationship of multiple factors that may be playing a role in the pathogenesis of essential hypertension. Additional multivariate statistical analyses were done to evaluate whether the several variables considered - relative weight, heart rate, post-load plasma glucose, serum cholesterol, and uric acid, haematocrit, cigarette smoking -- account for the racial difference. Stamler and his colleagues found that race was highly significantly related to blood pressure independent of the several other variables, i.e. these variables did not explain the higher prevalence of hypertension in blacks compared to whites.

Stamler et al (1975), with the use of three multivariate statistical procedures (partial correlation, multiple logistic regression and multiple linear regression), three variables --

relative weight, resting heart rate, and plasma glucose one hour after an oral load — were repeatedly found to be independently related to both diastolic and systolic blood pressure and to elevated pressure, with P values generally of $> .01$ or $> .001$. Serum cholesterol was significantly related to some but not all of the multivariate analyses. No positive association emerged in any of the analyses between cigarette smoking and blood pressure, or elevated blood pressure.

Hypertension as risk of Mortality

Hypertension has been shown to be a risk of mortality. Abundant data on mortality and elevated blood pressure have been published by the Build and blood Pressure study (Society of Actuaries, 1959). These data covered the experience of 26 large life insurance companies involving about 4 million policies issued to men and women from 1935 to 1953 (Lew, 1973). Among of the most significant findings of the Build and Blood Pressure study of the Society of Actuaries was that the rate of mortality increased proportionally with blood pressure level, even in the range not generally considered extreme by clinical criteria, and that mortality was lowest among persons with blood pressures distinctly below average. In so far as longevity is concerned ".....average blood pressures are significantly higher than optimal blood pressures" (Lew, 1973).

In recent years abundant data have been accumulated from other sources which support the findings of actuarial studies. Prospective epidemiological studies indicate a significant and consistent rise in death rate with increasing levels of systolic and/or diastolic blood pressure (Borhani et al. 1963; Borhani,

1966, 1972, 1974; Kannel, 1969; Stamler, 1967, 1969). It is of interest to note that none of these epidemiological studies suggest a critical cut off point or threshold of blood pressure that can be used as a predictor of mortality. They all confirm Pickering's (1968) concept that arterial blood pressure is a biologic quantity and that the level of blood pressure is a continuous variable when it is considered as a risk of mortality.

Hypertension as Risk of Morbidity

Elevated blood pressure has been shown to be an important risk factor in the incidence of coronary heart disease, congestive heart failure, cerebrovascular and related diseases (Borhani et al. 1963, Kannel, 1970; Cassel, 1971; Stamler, 1967).

Evidence of Effectiveness of Antihypertensive Therapy

There is available evidence from controlled clinical trials regarding the effectiveness of antihypertensive therapy. The results of the randomized trials of treatment of essential hypertension by Wolff and Linderman (1966), and the Veterans Administration Cooperative Study Group on Antihypertensive Agents (1967, 1970), demonstrated a significantly lower incidence of morbidity and mortality in the treated than in the untreated group. The 523 patients selected for the study were randomized into placebo and active treatment groups. The active treatment consisted of a combination of hydrochlorothiazide, reserpine and hydralazine. It is concluded from these studies that medical treatment not only reduces the level of blood pressure but decreases the risk of morbidity and mortality associated with it. The Veterans Administration Cooperative study Group demonstrated significant and immediate response to treatment among those whose

diastolic blood pressures were in the range of 115 - 129 mm Hg. The Veterans Administration Cooperative Study did not, however, show whether the effect of lowering morbidity and mortality among men with mild hypertension (diastolic blood pressure of 90 to 104 mm Hg), was statistically significant.

Recently, the Hypertension Detection and Follow-up Programme Cooperative Group (1979) has shown that there is benefit to be derived from assiduous treatment of patients with diastolic blood pressure 90 to 104 mm Hg, and indeed any degree of hypertension. The study showed that there were reductions in mortality of 20% for all causes, 46% for stroke, and 47% for myocardial infarction in a five-year study with about 7000 screened and randomised subjects. The lesson from this study is clear. Physicians can no longer assume that mild, asymptomatic hypertension is harmless.

(ii) The Caribbean and Central America

A study of rural and urban populations in Jamaica (Miall et al. 1962) showed that hypertension was not only common there, but that there was a higher prevalence of hypertension in rural women than in urban women at almost all ages. The differences in the prevalence of hypertension could not be attributed to excess weight, migration or to a genetic basis. Among males, there was no difference in the mean blood pressure and in the prevalence of hypertension between urban and rural groups.

Studies done in the Virgin Island, (Saunders and Barcroft, 1942), in the Bahamas (Johnson and Remington, 1961) and in St Kitts (Schneckloth et al. 1962) showed that black

people in these areas had higher mean blood pressures and higher prevalence of hypertension than the Caucasians. From Panama and Central America came reports indicating the higher prevalence of blood pressures in black people than in Caucasians (Marvin and Smith, 1942; Taylor, 1945; Scrimshaw, 1947; Kean and Hammill, 1949).

(iii) New Zealand and the Pacific

In New Zealand there are Maori natives and Europeans living essentially in the same environment. From the report on Coronary heart disease prepared by the National Heart Foundation of New Zealand (1971) and in the Maori - European Comparison of Mortality Special Report (Rose, 1972), it was clear that from 1960 the Maori females had continued to show a much higher risk status for hypertensive heart disease and coronary heart disease than their European counterparts. Hypertensive heart disease rates were much lower in the Europeans. The Maori females aged 45 to 54 years appeared to have been more severely affected than their male counterparts. There were no significant differences between the Maori and European males.

The surveys of Prior (1974) found that the Maori males and females showed considerable rise in blood pressures with age and that the females reached higher systolic and diastolic pressures than males from age group 35 - 44 on. Although Prior's surveys found that hypertension was high in both Maori and European, the higher rates found in the Maori females were confirmed.

S U M M A R Y

The blood pressure of the black African rises with increase in age in many respects similar to his European counterparts.

Pockets of primitive indigenous African communities have been identified in whom the blood pressure does not rise with increase in age. Such communities are the Samburu tribesmen of northern Kenya, the bush men of Kalahari desert and the nomadic tribesmen of northern Nigeria.

Urban migrants, for example the Zulus, have higher blood pressure than their rural counterparts. Factors responsible for the differences in blood pressure have not been studied.

Contrary to earlier impressions that hypertension was uncommon in the African, the bulk of the evidence from the review of the literature points to the fact that hypertension is common in the black African.

Clinical studies and post-mortem reports have revealed that the risk of hypertension are high in the black African.

While there is evidence to show that the risks of hypertension in the black American is higher than his white counterpart, there is no evidence to show that the risks of hypertension at similar levels of blood pressure are the same in black Africans as they are in blacks elsewhere.

Hypertension is distinctly more common in the North American blacks than their white counterparts. Race has been found to be highly significantly related to blood pressure independent of several variable factors such as relative weight,

heart rate, post-load plasma glucose, serum cholesterol, haematocrit, and cigarette smoking, i.e. these variables did not explain the higher prevalence of hypertension in blacks compared to whites.

Evidence has been produced from randomised controlled trials which shows that significant lowering of incidence of morbidity and mortality result not only from treating patients with diastolic blood pressure 115 to 129 mm Hg, but also from treating patients with diastolic blood pressure 90 to 104 mm Hg, which had previously been considered mild and therefore neglected.

CHAPTER 4

METHODS AND RESULTS

Two populations in the Bendel State of Nigeria were defined - one rural and the other urban - and the study was carried out in two stages.

SUBJECTS

Rural Study:- Isiuwa village, a conglomeration of what were originally three smaller villages, is situated 36 kilometers north-west of Benin City. It occupies 1735 hectares of rolling country-side in the equatorial forest zone of Bendel State of Nigeria. The residential village is spread over 122 hectares of land whilst the remaining land is devoted to the growing of oil palm, coconut and raphia palms.

The population of Isiuwa village is about 5000 (private census, 1976). The ethnic groups residing in the village include several tribes (Edo, 59%; Ibo, 18%; Ibibio, 10%; Urhobo, 9%; Yoruba, 2%; and others, 2%).

The head of every household at Isiuwa village is employed at the Nigerian Institute for Oil Palm Research (NIFOR). NIFOR has overall responsibility for administration and welfare of Isiuwa village. NIFOR is also responsible for the cultivation of oil palms and the production of oil from the extensive palm plantation at Isiuwa village.

Out of the total 1500 male adults aged 15 to 60 years resident at Isiuwa village, 400 men work in the offices of NIFOR whilst 1100 men work as field labourers. Out of the field labourers 330 men (30%) were literate, judging by the ability to read and write.

Most of the 750 adult women who were present in Isiuwa village at the time of the survey were engaged in subsistence farming and 'petty trading'.

During the months of June and July 1976 1482 men and 600 women were examined.

Urban Study:- Benin City with a population of about 200,000 inhabitants (government census, 1963) is the capital city of Bendel State of Nigeria. The study is concerned with the clerical workforce of the state capital's secretariat. The secretariat is situated in the centre of the city and houses 12 government Ministries. At the time of the survey 970 males and 360 females aged between 15 and 60 years were in employment in the secretariat. 179 males (18.5%) and 34 females (9.4%) worked as senior administrative staff by being at the head of the various sub-units staffed by junior clerical workers. During the months of September, October and November 1977, 916 males and 347 females were examined.

METHODOLOGY

In both the rural and urban surveys blood pressure readings were taken using a standard mercury sphygmomanometer with a cuff size of 12 x 22 cm. All measurements were taken in the left arm between 09.00 and 13.00 hours after the subjects had been seated for 5 minutes. The systolic blood pressure was taken at the first appearance of sound whilst the diastolic blood pressure was taken at the point where there was an abrupt muffling of sound (phase 4). The author was the only observer in the measurement of blood pressure.

Using a standard questionnaire information was obtained from the respondents about name, address, age, sex, occupation, marital and educational status and position held at work. To confirm the accuracy of age statements, especially in cases where there were doubts, the respondents were encouraged to relate their age to historical records emerging from these areas such as dates of traditional festivities, missionary activities, national events and coronation of local kings. The general appearance of the subjects was sometimes relied on, and in the case of illiterate women, the year of marriage, the ages of their first born, and the onset of menopause aided verification of age. It was considered that it would be futile to attempt to estimate age more accurately than by 5 - year groups. All respondents had height and weight measured without shoes and with light clothing on. The Quetelet's index which is an index of body mass was calculated for each subject as $\text{weight (Kg)}/\text{height}^2 \text{ (cm)} \times 100$ (Khosla and Lowe, 1967). All respondents were asked about their smoking habits.

Urine samples from all the respondents were examined for protein and sugar using uristix strips (Ames).

For this study hypertension is defined as systolic blood pressures of 160 mm Hg and above, or diastolic blood pressures of 100 mm Hg and above, or a combination of both. Subjects whose blood pressures were below these given levels were considered normotensive.

Subjects with systolic blood pressures of 160 mm Hg and over or a diastolic blood pressure of 100 mm Hg and above, or a combination of both, were recalled for secondary screening

examination in the same location between 09.00 and 13.00 hours within a maximum period of 8 weeks and a minimum period of 7 days. All the subjects with blood pressures sustained at the levels described above were referred to a special clinic at the University of Benin Teaching Hospital.

R E S U L T S

RURAL SURVEY

Sample Statistics

- (i) Table 1 shows the age and sex distribution of all the 2082 (1482 males and 600 females) examined.
- (ii) Three hundred and eighty seven male office clerks and 1095 male field labourers were examined, giving a response rate of 96.8 per cent and 99.5 per cent respectively. The number of women examined was 600, giving a response rate of 80 per cent.
- (iii) Distribution of Mean Blood Pressure by Age and Sex
Figure 1 shows the distribution of the diastolic blood pressure for males and females. The distribution assumes a unimodal curve, skewed to the right with no dividing line to separate low blood pressure from high blood pressure. A similar curve was found for systolic blood pressure.
- (iv) Mean Blood Pressure of Whole Population
The trend of systolic and diastolic pressure with age is illustrated graphically in Figure 2. It confirms a rise

of blood pressure with age. The mean values with their standard deviation (S.D) are given in Table 2.

(v) Mean Blood Pressure of Male Clerks and Labourers

The trend of systolic and diastolic pressures with age for the rural male clerks and labourers is illustrated graphically in Figure 3. The mean values with their S.D are given in Table 3. It can be seen that rural clerks had higher systolic and diastolic pressure than rural labourers but the differences in mean blood pressures were not statistically significant.

(vi) Relationship of Body Mass and Blood Pressure

Figure 4 shows graphically that as the systolic pressure increased with age the Quetelet index (index of body mass) also increased slightly with age in both rural clerks and rural labourers. However, the differences in the Quetelet indices in each particular age groups were not statistically significant.

(vii) Blood Pressures of Literate and Illiterate Labourers

Mean systolic and diastolic blood pressures were calculated for 30 literate labourers sampled out of each of the 35 - 39 and 40 - 44 year age-groups and compared with a similar number of illiterate labourers from the same age groups. No significant difference in the mean pressures were found.

(viii) Blood Pressures of the Edo ethnic groups
and the non-Edo ethnic groups

Mean systolic and diastolic pressures were calculated for the male Edo ethnic group and the non-Edo ethnic groups in the age groups 30 - 34, 35 - 39, 40 - 44, 45 - 49, where the numbers allowed for such comparison. No significant difference in mean pressures were found.

(ix) Prevalence of Hypertension

105 males (7.1%) and 18 females (3.0%) were found to be hypertensive at the primary examination in Isiuwa village. Only 3 males were encountered who were previously known to be hypertensive.

(x) Effect of Re-Examination

When the 105 hypertensive males and 18 females were re-examined 7 days later only 41 males (2.8%) and 3 females (0.5%) were found to remain hypertensive.

(xi) Urinalysis

Three males and one female had glycosuria. Diabetes mellitus was confirmed by oral glucose tolerance test in two of the males and in the only female.

The numbers of subjects who had proteinuria at the primary screening were 79 (5.3%) males and 36 (6.0%) females. When the urine of these subjects with proteinuria were examined microscopically only in one male subject were pus cells and/or hyaline casts found and this subject was hypertensive.

(xii) Smoking and Blood Pressure

Eight males (2%) among the rural clerks and 12 males (1.1%) among the rural labourers smoked between 5 and 10 cigarettes daily. They were all normotensive.

Figure 1

THE DISTRIBUTION OF DIASTOLIC BLOOD
PRESSURE ISIUWA VILLAGE (1976)

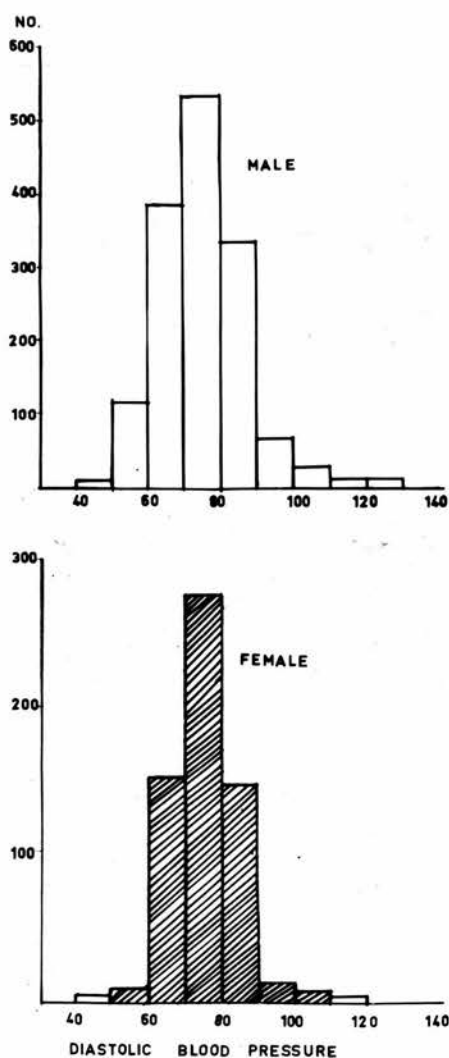


Figure 2

DISTRIBUTION OF MEAN BLOOD PRESSURE
BY AGE AND SEX (ISIUWA VILLAGE, 1975)

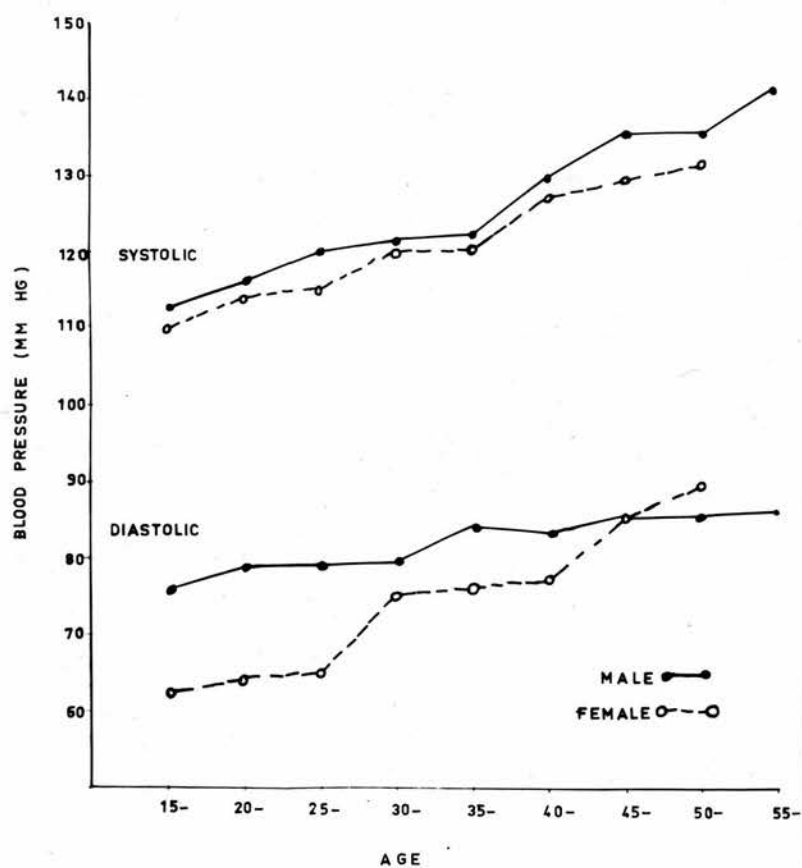


Figure 3

MEAN SYSTOLIC AND DIASTOLIC PRESSURES
IN RURAL OFFICE CLERKS AND LABOURERS.

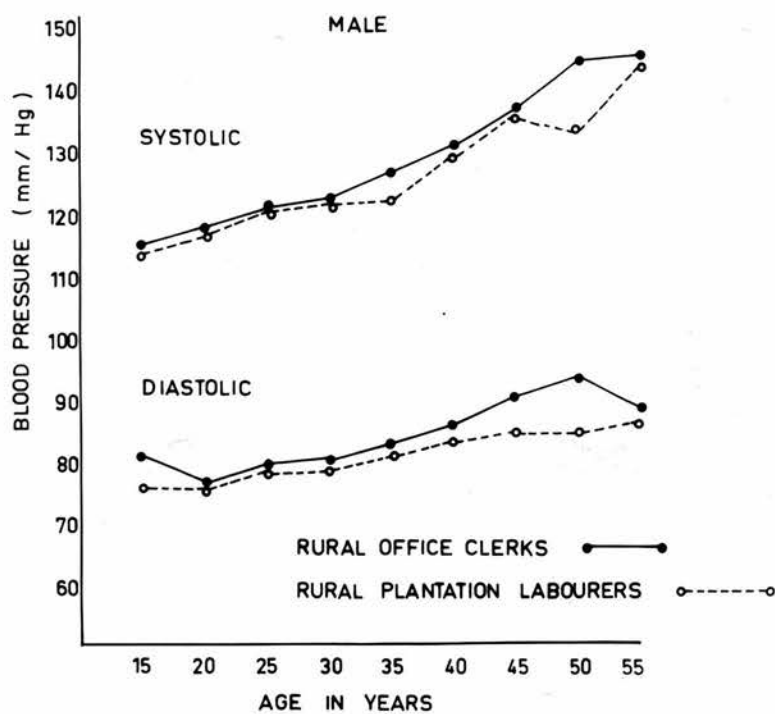
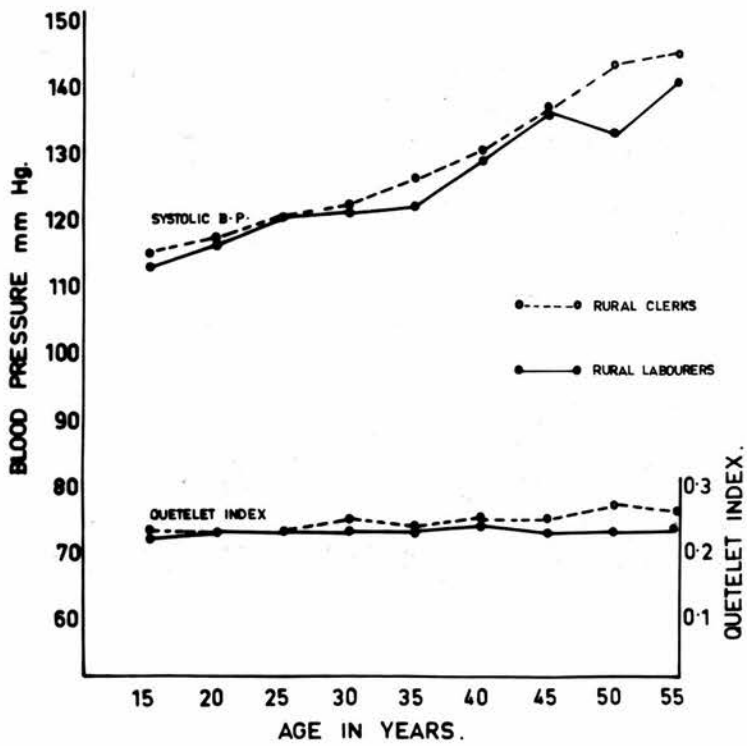


Figure 4

RELATIONSHIP BETWEEN QUETELET INDEX AND
BLOOD PRESSURE - RURAL MALE.



URBAN SURVEY

(i) Sample Statistics

Table 5 shows the age and sex distribution of the subjects examined in the City.

- (ii) Nine hundred and sixteen males and 347 females were examined, giving a response rate of 94.4 per cent and 96.4 per cent respectively.

(iii) Distribution of Mean Blood Pressure by Age and Sex

The distribution of diastolic blood pressure is shown in Figure 5. The distribution assumes a unimodal curve, skewed to the right with no dividing line to separate low blood pressure from high blood pressure. A similar curve was found for the systolic pressure.

- (iv) Figure 6 expresses graphically the mean systolic and diastolic pressure for males and females and it shows a rise in both systolic and diastolic pressure with advancing age. The mean values with their S.D are given in Table 6.

(v) Mean Blood Pressure of Senior and Junior

Office Workers

When the mean blood pressure of the senior office staff were compared with those of the junior office clerks in similar age groups, no significant differences were found between the two groups.

(vi) Relationship of Body Mass and Blood Pressure

Figure 7 shows graphically that as the systolic pressure increased with age the Quetelet index (index of body mass) also increased slightly with age. The increase in blood pressure with body mass is noticeable in all age groups in the case of males and from the age of 15 to 40 years in the case of females.

(vii) Prevalence of Hypertension

One hundred and thirty two (14.4%) out of 916 males examined and 36 (10.4%) out of 347 females examined were found to be hypertensive at the primary examination.

Ten respondents (6 males and 4 females) all over the age of 35 years were encountered who were previously known to be hypertensive and who were currently on treatment. In the 10 respondents the blood pressures were above the levels defined for hypertension.

(viii) Effect of Re-examination

When the 132 hypertensive males and 36 females were re-examined 7 days later only 84 males (9.2%) and 22 females (6.3%) were found to remain hypertensive.

(ix) Urinalysis

Seven males and one female had glycosuria at the primary examination. When oral glucose tolerance tests were performed on them, diabetes mellitus was confirmed in 4 of the males (0.4%) and in the only female (0.2%).

The numbers of subjects who had proteinuria at the primary examination were 98 males (10.7%) and 28 females (3.1%). When the urine of these subjects with proteinuria were examined microscopically only in two males and one female were pus cells and/or hyaline casts found and these three subjects were hypertensive.

(x) Smoking and Blood Pressure

Twenty seven males (2.5%) smoked between 5 and 10 cigarettes daily. None of the females smoked cigarettes. All the smokers were normotensive.

Figure 5

THE DISTRIBUTION OF DIASTOLIC
BLOOD PRESSURE-URBAN SUBJECTS.

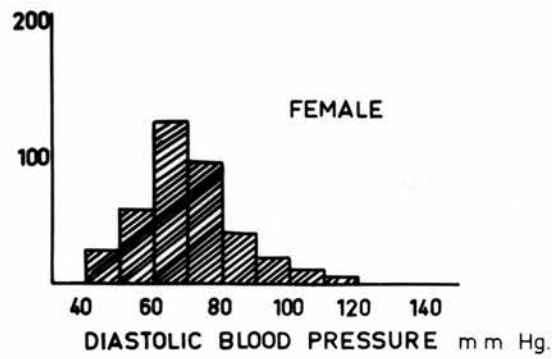
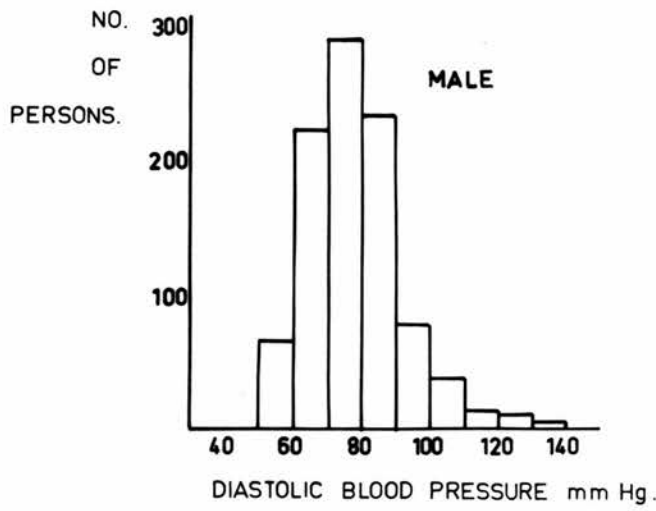


Figure 6

MEAN SYSTOLIC AND DIASTOLIC PRESSURES
IN URBAN MALES AND FEMALES.

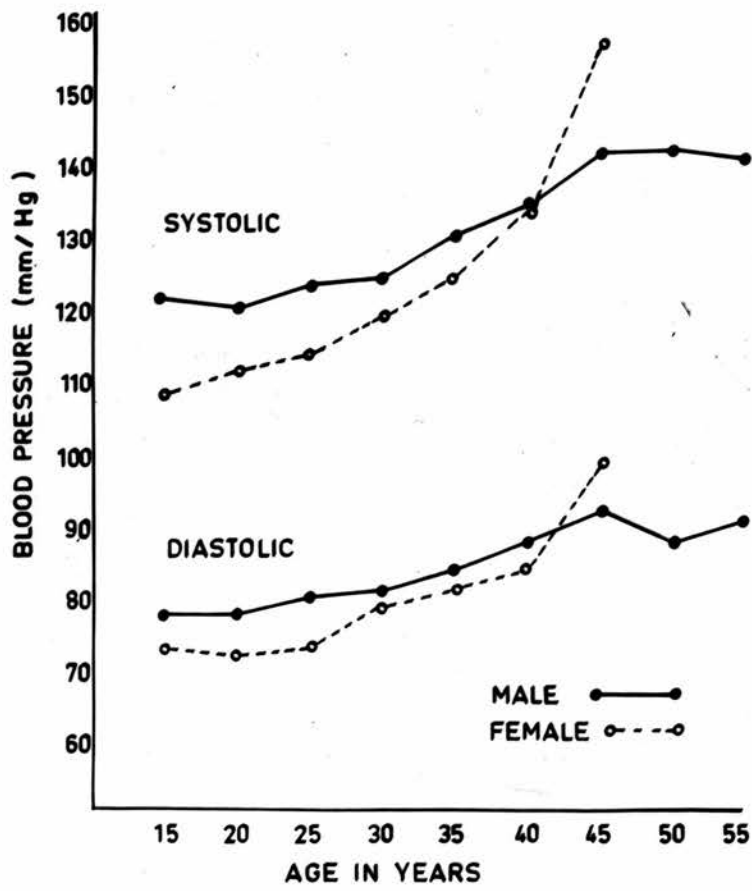
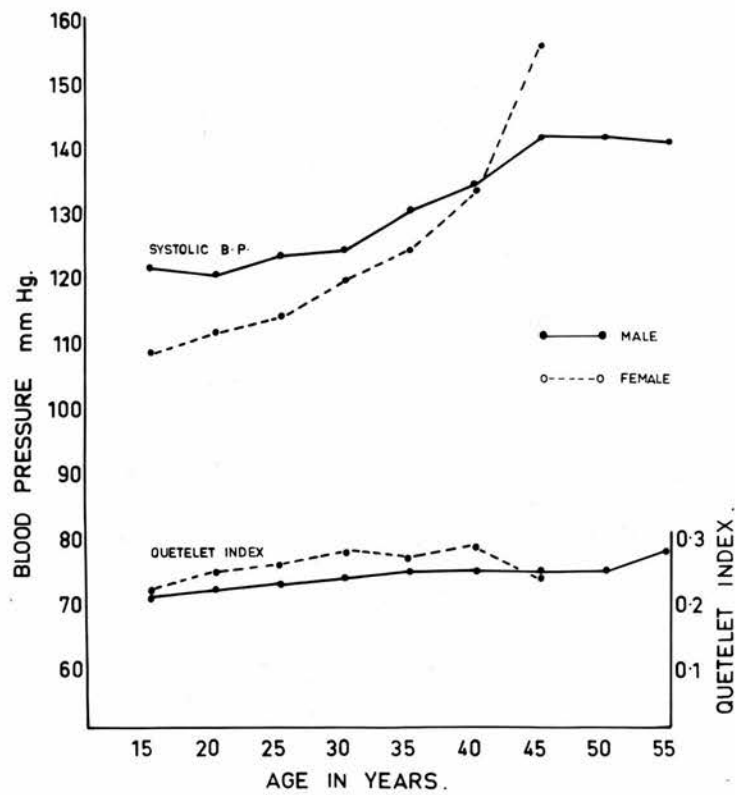


Figure 7

RELATIONSHIP BETWEEN QUETELET INDEX AND
BLOOD PRESSURE - URBAN SUBJECTS.



MEAN BLOOD PRESSURES OF URBAN AND
RURAL SUBJECTS COMPARED

(i) Mean Blood Pressures

The mean systolic and diastolic blood pressures for the entire rural and urban subjects examined are expressed graphically in Figure 8 (urban and rural males) and Figure 9 (urban and rural females). It can be seen that for both males and females the mean blood pressures for the urban subjects were generally higher than those for the rural subjects.

When two sample Student's t tests were carried out to compare the mean blood pressure of the rural and urban populations, only in certain age groups were the differences found significant, Table 7.

(ii) Rural Clerks Versus Rural Labourers

Rural Clerks Versus Urban Clerks

Figure 10 expresses graphically the mean values of the systolic and diastolic pressures of rural clerks, rural labourers and urban clerks.

It can be seen that rural clerks had higher systolic and diastolic pressures than rural labourers, whilst urban clerks had higher systolic and diastolic pressures than rural clerks.

Two sample Student's t tests were carried out to compare the mean blood pressure of rural clerks with that of rural labourers and also the mean blood pressure of rural clerks with that of urban clerks. None of the comparisons was significant.

Figure 8

MEAN SYSTOLIC AND DIASTOLIC PRESSURES
IN URBAN AND RURAL SUBJECTS.

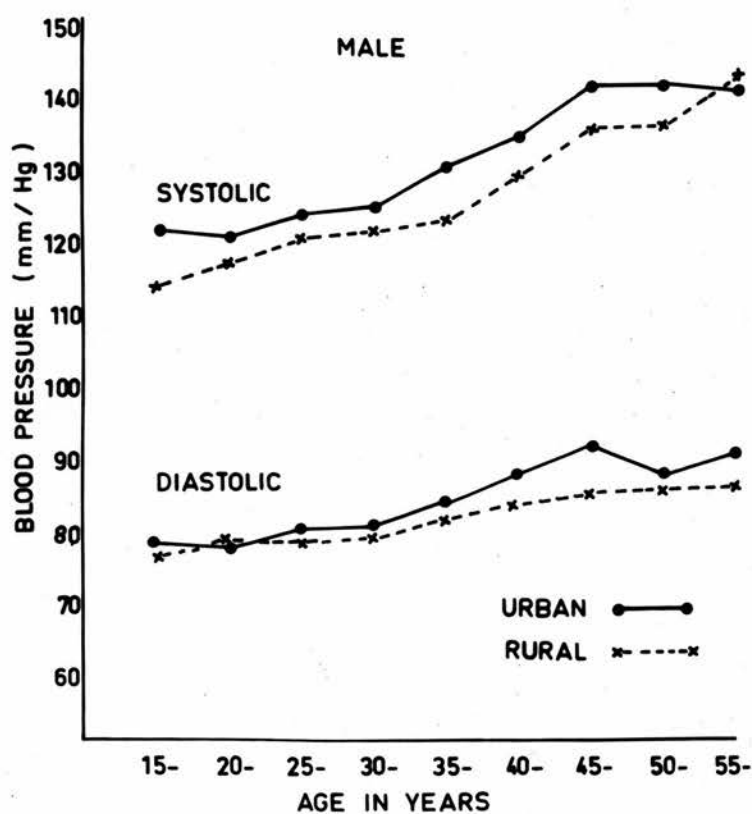


Figure 9

MEAN SYSTOLIC AND DIASTOLIC PRESSURES
IN URBAN AND RURAL SUBJECTS

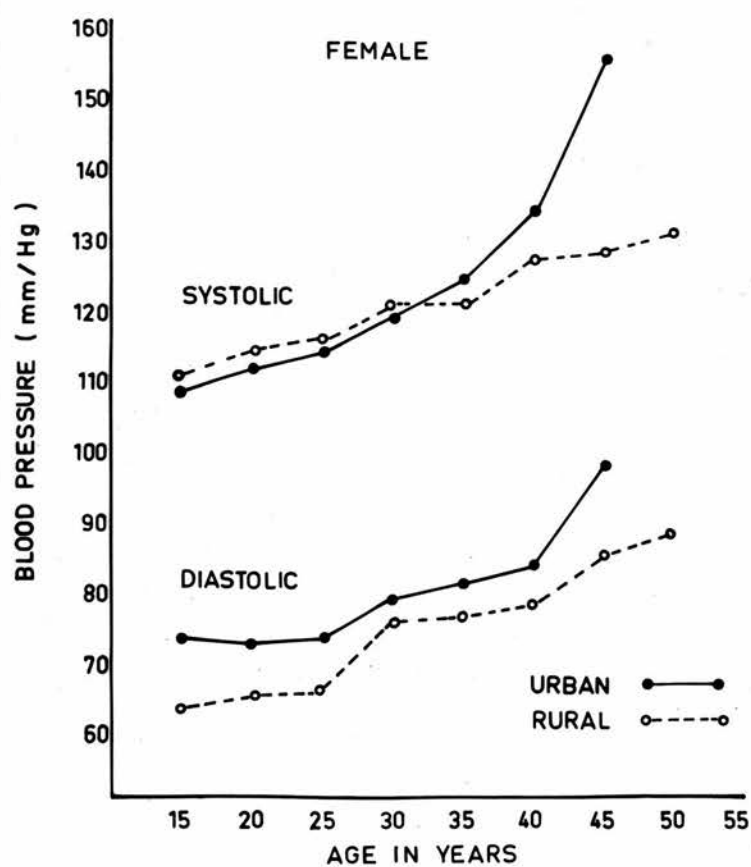
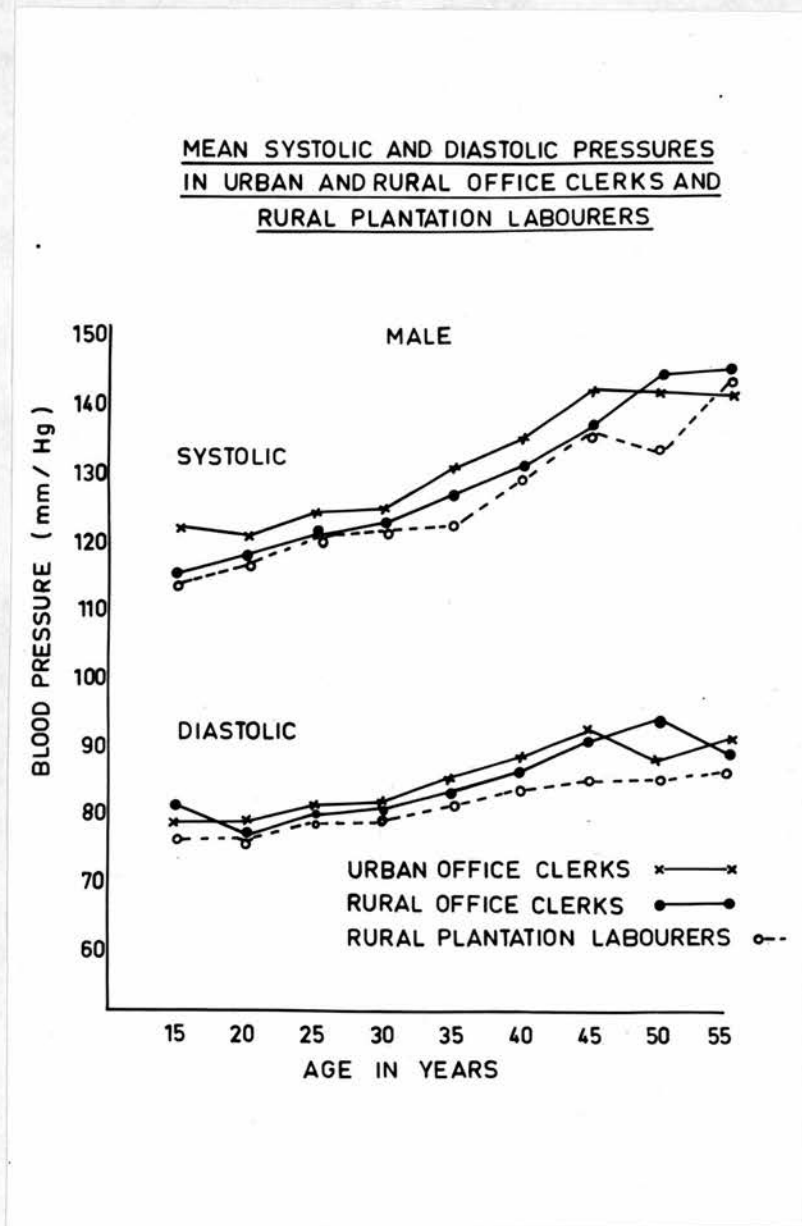


Figure 10

CHAPTER 5

FOLLOW-UP STUDY OF SUBJECTS WITH HYPERTENSION

Introduction

Subjects who remained hypertensive at the re-examination during the survey were invited to a special clinic conducted by the author at the University of Benin Teaching Hospital (UBTH). The aims of this follow-up exercise were

- (i) To make a clinical evaluation of the subjects found hypertensive.
- (ii) To offer treatment to the subjects
- (iii) To find out the problems encountered during follow-up.

Offering treatment to the subjects needs some explanation. The subjects who were referred from the rural survey had their drugs paid for and supplied free at their local dispensary at Isiuwa village. However, they had to bear the cost of travelling the 36 kilometers to see a Physician in the UBTH Clinic and also they had to pay a fee to the hospital for seeing a physician. The subjects who were referred from the survey in the Government's secretariat in the city had to pay for their transportation to the hospital, a distance of seven kilometers, the hospital's consultation fees and drug fees.

Clinical Evaluation: All subjects who were seen in the hospital had a thorough physical examination done. This included ophthalmoscopic examination of the fundus in a darkened room. The midstream specimen of urine was collected from every subject,

examined microscopically and tested for protein and sugar. Where the urine microscopy showed the presence of hyaline casts and, or pus cells blood was taken for electrolytes and urea estimation. Electrocardiography was recorded on every subject using a Philips Cardiopan 531 direct writing machine. A modified form of the Minnesota code was used in analysing the electrocardiogram. The criteria for left ventricular hypertrophy are shown in Table 8.

At the end of six months the subjects who had defaulted were traced and interviewed to find out reasons for defaulting from the clinic.

Results of Evaluation:

(i) The age and sex distribution of the subjects referred to hospital are shown in Table 9. 84 males and 22 females from the rural survey and 41 males and 3 females from the urban survey were referred to hospital, giving a total of 125 males and 25 females.

(ii) As far as was possible to determine with the facilities available, the aetiology of hypertension as found among the subjects is shown in Table 10.

The aetiology of hypertension was not known in 125 (83.3%) of the 150 cases referred to hospital and these were therefore considered to have essential hypertension.

Results of investigations of urine microscopy, electrolytes and urea and intravenous pyelography enabled

chronic nephritis to be found as the cause of hypertension in three males and one female.

Gross obesity was associated with hypertension in one female whose weight was 120 kg.

Coarctation of the aorta was found in one male.

(iii) Hypertensive retinopathy as shown by the presence of exudates and haemorrhages was found in two males (1.6%) and in none of the females.

(iv) Left ventricular hypertrophy was the commonest electrocardiographic evidence of hypertensive heart disease and this abnormality was present in 40 males (32%) and 5 females (20%) of those referred to hospital. ST segment depression and pathological T-waves were common among the subjects who had left ventricular hypertrophy.

Treatment Policy: It was my policy to offer mild hypotensive drugs in the first instance to the subjects whose blood pressures were at or above 160 mm Hg systolic and/or 100 mm Hg diastolic. The thiazide group of diuretics, brinerdin and adrenergic beta-receptor blockers fall into this group of mild hypotensive drugs. Brinerdin is a combination of alpha-adrenergic receptor blocker (dihydroergocristine) with a thiazide diuretic (clopamide) and reserpine.

My past experience in using these drugs has convinced me of their effectiveness under local conditions. Brinerdin was chosen here because it was the least expensive of the three drugs.

Brinerdin was administered to the subjects at a dose of one tablet twice daily. Subjects were seen at the clinic two weeks after the first attendance and thereafter every four weeks. At the end of the first two weeks, if the blood pressure lowering was considered unsatisfactory the dose of brinerdin was increased to one tablet three times daily. The lowering of the blood pressure was considered as satisfactory if the standing diastolic pressure was less than the pre-treatment standing diastolic pressure by 10 mm Hg or more.

During the subsequent attendance at clinic enquiries were made to ascertain whether the subjects had taken their drugs regularly and in the correct doses. Notes were taken of any unpleasant side effects due to drugs detected by the Physician or complained of by the subjects.

Results of Treatment

One hundred and fifty subjects (125 males and 25 females) started the treatment. At the end of three months 45 subjects (30%) had defaulted. Satisfactory lowering of blood pressure was achieved in 85 subjects (80.95%) out of the 105 subjects who did not default during the first three months. Twenty out of the remaining 25 subjects had not taken their drugs regularly and when they did they had taken inadequate doses. Five subjects did not respond satisfactorily to brinerdin inspite of increasing the dosage.

The numbers of subjects who defaulted from the hypertension clinic during the first one year are shown in Table 11.

Forty five subjects had defaulted during the first three months while a total of 74 defaulted at the end of one year.

Sixty (81%) of the defaulters were traced and interviewed at the end of the first six months. The reasons given for defaulting from the clinic are shown in Table 12. Lack of symptoms and a feeling of well being accounted for half of the cases of defaulting. Financial constraints account for about a quarter of the cases of defaulting. The unpleasant side effects complained of were fainting due to postural hypotension in two cases, irritability and insomnia in two cases and frequency of micturition in two cases.

CHAPTER 6

DISCUSSION

High blood pressure is considered to be the result of environmental influences acting over time on the genetically predisposed individual (Pickering, 1967). The rural and urban communities studied here provided an ideal location for studying factors related to high blood pressure.

This study has confirmed that in both sexes in the rural and urban populations there is a rise in systolic and diastolic pressure with age. This finding is in line with those of Abrahams et al (1960), Akinkugbe and Ojo (1969), Johnson (1971), who reported on arterial blood pressure among the Yoruba speaking tribe of the former Western region of Nigeria. The rise of blood pressure with age found in this study, however, differs from that of Etta and Watson (1976), who observed that the blood pressure did not rise until the age of 50 years among the nomads in the Zaria emirate of Northern Nigeria.

This study has confirmed that the mean systolic and diastolic pressure of urban subjects were generally higher than those of rural subjects of comparable age groups in both sexes. This finding is in line with the only previous report from Nigeria (Akinkugbe and Ojo, 1969) and the only known study from Ghana (Pobee et al. 1977) in which mean arterial blood pressures were observed to be generally higher in urban than in rural subjects. It is, however, not known whether this difference is due to occupation or to environment. It had earlier been observed (Scotch, 1960) that urban Zulus in South Africa had higher blood pressure than rural Zulus.

The finding of higher mean blood pressure in the urban subjects than in the rural subjects in West Africa and in South Africa appears to be in conflict with the findings in the West Indies. In the West Indian populations studied by them Miall et al. (1962) noted that mean arterial pressures were higher in women from rural than from the urban areas. They could not attribute the difference to excess weight, migration or to a genetic basis.

The studies of Akinkugbe and Ojo (1969), Pobee et al. (1977), were not designed to elucidate factors that could explain the differences in the mean blood pressures in rural and urban subjects. Among the Zulus it had been observed that the "individuals most likely to be hypertensive were those who maintained traditional cultural practices and who were unable to adapt successfully to the demands of urban living" (Scotch, 1963). This observation was based on the impression of an anthropologist.

This study started on the premise that if differences could be observed in the mean blood pressure of subjects in comparable age groups who were engaged in occupations of varying degrees of physical exertion, occupation involving physical exertion as opposed to sedentary occupations, could then partly explain such differences found in the blood pressure. It has clearly been shown in this study the consistently higher mean arterial pressure of one occupational group over the other, even where both occupational groups share a common environment. Rural Office Clerks had higher mean arterial pressure than rural field labourers whilst urban office clerks had higher mean arterial pressure than rural clerks (Figure 10).

The finding of higher blood pressure in rural male clerks than in rural male labourers bears apparent similarities to those of Miall (1959) who found that arterial pressures were significantly higher in men previously employed mainly in light occupations than in those in heavy occupations. Miall (1959) claimed support for his findings from the Occupational Mortality Supplement of the Registrar - General (1958) where it was reported that standardised mortality ratios for hypertension, vascular lesions of the central nervous system, and coronary disease were greatly increased in the light occupation groups.

Morris and Crawford (1958) have suggested a relationship between physical activity, hypertension and ischaemic heart disease. In their analysis of a national necropsy survey they found that hypertension, based on clinical and pathological findings, was less common and occurred 10 to 15 years later in men previously employed in heavy occupations than in others.

The prevalence of hypertension of 14.4 per cent for males and 10.4 per cent for females in the urban population of this study is significantly higher than the 7.1 per cent for males and 3.0 per cent for females in the rural study. This would confirm what has been suggested in Ghana (Pobee et al 1977) that hypertension is mainly a problem of the urban population in Africans. The prevalence of hypertension found in the urban population of this study is similar to that found in the City of Lagos in Nigeria as reported by Johnson (1971). Both Benin City and Lagos have in common their roles of being capital cities and centres of large trade and industries.

It is noteworthy that re-examination of subjects can substantially reduce the number of hypertensives found at surveys

as has been shown in this study. In the urban population screened 14.4 per cent of males and 10.4 per cent of females were found to be hypertensive at the primary examination but after re-examination only 10.4 per cent of the males and 6.3 per cent of the females remained hypertensive. Similarly in the rural population 7.1 per cent of the males and 3.0 per cent of the females who were found hypertensive at the primary screening were reduced by re-examination to 2.8 per cent males and 0.5 per cent females respectively. This observation further highlights the marked variability of casual blood pressure readings and underlines the need for repeated examination — particularly after adequate rest — before subjects are labelled "hypertensive". Armitage and Rose (1966) have shown that misclassification of subjects can be considerably reduced, for both systolic and diastolic measurements, by re-examination of subjects. Re-examination of subjects increases the precision of the blood pressure estimation very greatly. This has been confirmed in several studies among some communities in Scotland (Hawthorne et al. 1974) and in the Charlottesville blood pressure survey (Carey et al. 1976) where re-examination reduced substantially the number of hypertensives picked up at the primary examination.

In the urban population of this study 10.7 per cent and 8.1 per cent of the males and females respectively had proteinuria. The comparable figures found in the rural population were 5.3 per cent and 6.8 per cent for males and females respectively. However, it was found that only in three males and one female did proteinuria coexist with hypertension.

The prevalence of proteinuria in this study is low compared with those reported from studies in the Yoruba speaking areas of the former Western Region of Nigeria. Akinkugbe and Ojo (1969) found a prevalence of proteinuria of 11.2 per cent and 6.4 per cent in urban males and females respectively at Ibadan. They also found 17.7 per cent and 16.7 per cent in the rural males and females respectively. Oyediran et al. (1976) found a prevalence of proteinuria of 48.3 per cent and 39.6 per cent in males and females respectively at Epe. Both Ibadan and Epe are areas known to be endemic for schistosomiasis whereas Benin City is relatively free from schistosomiasis.

At the Epe survey 86 hypertensive subjects were registered out of 4,198 subjects above the age of 5 years screened. The low yield of hypertensives from this area endemic for schistosomiasis would suggest that schistosomiasis is not an important aetiological factor in hypertension. In support of this impression, Pobee (1975), after reviewing the literature on the relationship between renal disease, schistosomiasis and hypertension concluded that schistosomiasis is not an important aetiological factor in hypertension.

Quetelet's index was chosen as an index of body mass based on a review of population weight for height because it was considered as the least correlated with height and most correlated with independent measurements of obesity (Khosla and Lowe, 1967). It has been found in this study that subjects with higher blood pressures also had higher Quetelet indices. However, the differences in the Quetelet Indices between the rural clerks and labourers were not statistically significant.

Although the association of weight with blood pressure has been well documented (Kannel et al. 1967, Miall et al. 1968, and Ashley et al. 1974), it is not possible to show from this study that the differences in the arterial pressures between rural and urban subjects are due to weight.

The number of subjects who smoked cigarettes in our study is small compared with those studied in the reports of Stamler et al. (1975). It is not considered that smoking had any influence on the findings of this study. Stamler et al. (1975) in a report based on cross - sectional and prospective epidemiological studies in Chicago, found no positive relationship between cigarette smoking and blood pressure.

The rural clerks and rural labourers studied, both share a common environment, drink water from the same stream, and both eat predominantly high carbohydrate diets with vegetable oil, some meat and fish. No attempt was made to estimate the salt intake of the subjects studied. Dahl and Love (1954, 1957) presented evidence that those who take additional salt with their food at table have higher pressures than those who do not.

The occupations of the subjects of this study, however, differ in the degrees of physical activities. The clerks are engaged in sedentary occupations while the labourers are physically active clearing, planting and harvesting palm nuts. It could be argued that there might be a number of factors which determine whether a man does physically active work in the fields or sedentary work in an office. One of such factors could be selection (often self selection) on the basis of health and fitness.

Yes, this is true, but in Nigeria the principal factor which decides whether a man works as a labourer in the fields or as a clerk in the office is the level of education. The well educated man is chosen to work in the office by employers and the non-educated or one with partial primary school education has no prospect of being employed in the office and has to pick up a labourer's job or at best becomes self-employed as a petty trader. It must, however, be pointed out that all the employed subjects in NIFOR and in the government's offices had to undergo pre-employment medical examination to ascertain their physical and mental fitness.

The subjects also differ in literacy. While all the clerks are literate, only 30% of the field labourers are literate. Important differences in mean blood pressures might arise when comparing two groups, one literate and one illiterate. Distribution of blood pressure is also known to be influenced by socio-economic, cultural and educational factors. However, in this study important differences in mean pressures have not been found between the literate and illiterate labourers sampled from 35 - 39 and 40 - 44 year age - groups where the numbers of subjects allowed for such comparison. It is therefore not considered that the influence of education could account for the differences in mean pressures of the field labourers and office clerks.

The mean blood pressure of the urban senior office staff did not differ significantly from those of the junior office staff in the same age groups. The possible influence of executive responsibility on blood pressure could not be inferred from this study.

Certain problems arose during the survey. There were problems of age verification, more so in the rural area than in the urban area. Age verification has been described in details under 'Methods'. It was considered that it would be futile to attempt to estimate age more accurately than 5 - year groups. Women of Edo ethnic origin were frequently found in the rural survey to be reluctant to give details of their parity. Apparently there is some taboo in Edo customs against counting births. Information on parity was sought to find out if parity had any relationship with blood pressure. Because of paucity of information on parity this aspect of the work could not be achieved. Five of the subjects, four males and one female who presented for examination in the urban survey refused to have their blood pressure examined. Two of the subjects claimed that they were hypertensive and would rather not be bothered. Three of the subjects did not want to be used as 'guinea pigs'. Women in the rural study were more difficult to persuade to present themselves for examination. For them their farming and petty trading took precedence over anything else. Among the males non-response was usually due to absence from work because of holidays or ill health. The difficulties encountered did not, however, materially affect the findings of this work.

In the clinical study of the 150 subjects referred to hospital from the surveys essential hypertension accounts for the majority of cases in both sexes. This confirms what has been reported from other parts of Nigeria (Smith, 1966; Akinkugbe 1969).

Electrocardiograms were done on the 150 subjects and in none of them was there evidence of myocardial infarction. This finding is in agreement with what has been generally observed in Benin and other teaching centres in Nigeria that ischaemic heart disease is rare in the Nigerian (Oviasu, 1973). Left ventricular hypertrophy was present in 30 per cent of the subjects and this finding is in agreement with what has been reported before, that hypertensive heart disease is the commonest type of cardiac disease in Nigeria (Laukner et al 1961; Parry and Ikeme, 1966; Carlisle and Ogunlesi, 1972).

Hypertensive retinopathy was found in only 2 males (1.6 per cent) and this finding appears to support Akinkugbe's (1968) report that hypertensive retinopathy was rare in the African. The finding is, however, in contrast to a previous report from the University of Benin Teaching Hospital (U.B.T.H) in which 41 (35.7%) out of 115 patients studied in a 30-month period were found to have hypertensive retinopathy (Oviasu, 1976). It must be pointed out, however, that the 115 patients studied were patients seen in hospital because of severe complicated hypertension and had presumably had long standing hypertension whereas those 150 subjects who constitute the present study were referred to hospital from surveys. They have probably been picked up earlier. While none of the 150 subjects had papilloedema indicating malignant hypertension, 13 (11.3%) of the 115 reported earlier from UBTH had papilloedema.

Non-compliance with treatment constitute a big problem and poses a great challenge to the successful management of the hypertensive patient. The difficulties found during the follow-up of subjects are described in details in the next chapter.

CHAPTER 7

LOCAL PROBLEMS IN MANAGEMENT OF HYPERTENSION

What strikes one most in running a hypertension clinic in Benin City is the lack of understanding of the implications of hypertension by the vast majority of patients. During the eight years I have spent in running the hypertension clinic in the University of Benin Teaching Hospital, my attempts at explaining the implications of hypertension to patients both in English and the local vernacular language have not made much impression. The low level of education or the lack of it in the majority of patients may have contributed to this lack of understanding. But I can also recall several well educated patients, who, inspite of explanations of the implications of hypertension, have ignored my advice and defaulted from treatment.

To the lack of understanding of the implications of hypertension can be added the attitude of the Nigerian to illness. Una Maclean (1971) observed that many Nigerians believe that witchcraft together with the angers and whims of the capricious gods are some of the prime causes for disease and personal disaster. I have found that this belief is especially strong in patients and their close relations when patients are admitted with severe cardiac failure due to hypertension or when they are moribund from any illness. The wrong belief in the cause of illness is sometimes responsible for patients defaulting from the authodox medical treatment and resorting to traditional treatments and to practitioners of esoteric healing arts.

Once drug therapy for hypertension has been initiated, it has to be continued indefinitely. Patients' compliance has been found to be poor, particularly when there is no evidence of hypertensive complications. This has been the finding in this study where at the end of one year of follow-up 49.3 per cent of the subjects attending hypertension clinic had defaulted from the clinic. It is a frequent experience in the medical wards to find previously treated patients being readmitted in cardiac failure due to hypertension after defaulting from follow-up management.

Physicians with special interest in hypertension who can afford to devote adequate time for follow-up are few at the moment in Nigeria. Even if hypertensive patients will attend clinic regularly, except in the few University Teaching Hospitals in Nigeria, patients' compliance may be bedevilled by the lack of physicians with interest in hypertension.

The cost of drug treatment and hospital attendance have been found in this study to be one factor militating against patients' compliance. Medical treatment is not free in Nigeria. Hospital attendance fees and the cost of anti-hypertensive drugs are escalating. In a country where the health care and delivery are largely borne by the government already saddled with so many other priorities, it is impossible to meet the needs of the majority of patients with hypertension.

If it is considered that the problems in the management of hypertension encountered in this study is the tip of an iceberg one can imagine that the magnitude of the problem of hypertension in Nigeria is gigantic. Nor are these problems peculiar to Benin or indeed Nigeria.

During a symposium on hypertension in Africa held in Abidjan, Ivory Coast in 1974, the economic problems encountered in the management of hypertension in the African were highlighted by contributors from various African countries (Falase and Salako, 1975; Adi, 1975; Bando, 1975; Larbi, 1975; Menard et al. 1975. The economic and social problems highlighted were no different from those encountered in Benin.

Besides the attitude of the Nigerian to illness to which reference has already been made in this text, a different type of problem is posed by the attitude of patients to drug taking and their understanding and consumption of prescribed drugs. Hypertensive patients were frequently encountered, who inspite of explanations on how to take drugs, did not take the drugs as prescribed. Added to these were the difficulties patients encountered during collection of drugs from hospital pharmacy. The hospital pharmacy was frequently overcrowded by patients seeking drugs. After waiting several hours in hospital pharmacy patients were frequently frustrated at finding that the drugs they had waited for were not available. These problems are not peculiar to Benin and are common all over the country. Similar problems based on experiences at the University College Hospital, Ibadan, have been described in details by Salako and Adadevoh (1972a, 1972b).

Suggestions for Solving Problems:

1. Nigerians would have to be more informed on the implications of hypertension. This should be done in both English and the local vernacular language through the radio, newspapers, television, and discussions at local community levels.

People should be made to understand that a lot could be done to prevent the serious consequences of hypertension with modern treatment.

2. The Federal and State governments of Nigeria should be urged to evolve a more realistic health care policy and delivery. If it is not possible to make hospital treatment free at the moment, the Governments should at least exempt patients from paying fees in certain categories of illness such as hypertension and tuberculosis.
3. Since it is not possible to produce enough doctors for Nigeria in the next decade, a programme of training medical auxiliaries to work at several stations should be evolved by the Federal Government. Doctors could then concentrate on the more serious illnesses.
4. Since physicians with interest in hypertension are not many, a programme of continuing medical education should be initiated at the few University Teaching Hospitals in Nigeria and doctors working in the neighbouring towns should be invited and encouraged to participate.
5. The hospital pharmacies should be reorganised and more pharmacists and their assistants employed to attend to patients who come to collect drugs. A task force should be set up to ensure that essential drugs are always available.
6. As a means of reducing the cost of drugs, the Federal Government of Nigeria should abolish import duties on drugs.

7. The Federal Government should urge the big firms/ companies who constitute non-governmental employers of labour to arrange for free medical treatment for their employees.

8. Embarking on case finding of hypertension is expensive both in terms of money and human resources. It may have to wait (except for research purposes) until the problems of management of hypertension has been largely solved. Large scale community control programmes of hypertension, whenever, it becomes feasible, should be directed at the urban communities where hypertension has been shown to be more prevalent.

In spite of all these suggestions it is realised that real solutions to the problems can only be achieved by cooperation on the part of patients, doctors, pharmacists, government agents, mass media and civic leaders and this is no mean feat.

CHAPTER 8

SUMMARY AND CONCLUSIONS

Summary

1. The aims of this study were —

To find the distribution of blood pressure and the prevalence of hypertension in the residents of Isiuwa village aged 15 to 60 years who were made up of 400 office clerks, 1100 field labourers and 750 housewives.

To repeat the study in a group of office clerks (970 males and 360 females) who constitute the civil service workforce in Benin City.

To find if there are differences in the mean blood pressure of the rural office clerks, rural field labourers, and the urban office clerks and to relate the blood pressure to factors (influences) such as age, sex, weight, education, urinalysis, smoking and occupation, as a means of possibly explaining the differences that have been reported in the blood pressure of rural and urban residents in Africans.

To find out the problems associated with the management and follow-up of hypertensive patients.

2. A comparative review of the blood pressures in different populations shows —

That the blood pressure of the black African rises with age, although pockets of primitive communities have been identified in whom the blood pressure does not rise with age e.g. the bush men of Kalahari desert and the Samburu tribes men of northern Kenya.

That hypertension is not uncommon in the black African and that the risks are high.

That the blood pressure of urban migrants tends to be higher than their rural counterparts.

That hypertension is more common and the consequences more severe in the black American than his white counterpart; that variable factors such as relative weight, heart rate, post-load plasma glucose and cigarette smoking did not explain the higher prevalence of hypertension in blacks compared to whites.

That there is benefit to be derived from treating any degree of hypertension.

3. Two populations in the Bendel State of Nigeria were defined — one rural, the other urban — and the study was carried out in two stages. 1482 males and 600 females were examined in the rural population. The following points emerged from the cross-sectional surveys in Isiuwa village (rural) and in Benin City (urban).

- (i) There was a rise of blood pressure with age in both sexes in all the subjects examined in Isiuwa village and in Benin City (Figs. 2 & 6).
- (ii) The mean systolic and diastolic blood pressures in both sexes in all the subjects examined in Benin City were generally higher than those examined in Isiuwa village (Figs. 8 & 9).
- (iii) 105 males (7.1%) and 18 females (3.0%) were found to be hypertensive at the primary examination in Isiuwa village, whilst 132 males (14.4%) and 36 females (10.4%) were found to be hypertensive at the primary examination in Benin City.

- (iv) Re-examination substantially reduced the number of hypertensives. At re-examination 41 males (2.8%) and 3 females (0.5%) were found to remain hypertensive at Isiuwa village, whilst 84 males (9.2%) and 22 females (6.3%) were found to remain hypertensive in Benin City.
- (v) The rural office clerks had higher mean systolic and diastolic pressures than the rural field labourers at Isiuwa village, whilst the urban office clerks had higher mean systolic and diastolic pressures than the rural office clerks. (Fig. 10).
- (vi) That relative weight, literacy, ethnic origin, urinalysis and smoking do explain the differences found in the mean blood pressures of rural field labourers, rural clerks and urban clerks.

4. Evaluation of the 150 subjects (125 males and 25 females) referred to hospital revealed that —

- (i) essential hypertension was the commonest type of hypertension encountered, being present in 125 cases (83.3%).
- (ii) Left ventricular hypertrophy was the commonest electrocardiographic evidence of hypertensive heart disease, and was found in 32 per cent and 20 per cent of the referred males and females respectively.

5. Follow-up study of patients revealed that —

- (i) Defaulting from follow-up treatment is a great problem in the management of hypertensive patients. The reasons for defaulting included lack of symptoms in the patients, lack of money to purchase drugs, resort to traditional healers and sometimes unpleasant side effects.
- (ii) Concrete suggestions are given for solving the problems in the management of hypertension in Nigeria. These include informing Nigerians on the implications of hypertension, urging the Federal Government to evolve a more realistic health care policy and delivery, training more medical auxiliaries, continuing medical education for doctors to stimulate interest in hypertension, abolishing import duties on drugs and reorganising hospital pharmacies.

C O N C L U S I O N

The findings of this study showed that the mean systolic and diastolic blood pressures of urban subjects (both men and women) were higher than those of rural subjects, but the differences were statistically significant only in certain age groups. In previous studies in Africans, the statistical significance of differences in arterial blood pressures between rural and urban subjects has not been tested.

It is not known, however, whether these differences are due to occupation, environment, or both. Although earlier studies in Europe showed blood pressure to be higher in persons with occupations involving little physical activity than in those who were more active, none of the small differences between occupational groups found in the present study were significant. An association between weight and blood pressure has been well documented in other studies, but it was not possible in the present study to show that the differences in arterial pressure between the rural and urban subjects were related to Quetelet's index.

In conclusion, it is not clear from the findings of my study whether the differences between rural labourers and urban clerks in any particular age-group should be attributed to occupation or to area of residence. However, the consistently intermediate values for rural clerks over the whole range of age-groups furnish strong indirect evidence that both these factors are relevant.

APPENDIX ITABLES OF RESULTSTable 1AGE AND SEX DISTRIBUTION OF
SUBJECTS SCREENED

Age group (years)	Male		Females	
	Number	%	Number	%
15 - 19	22	1.5	78	13.0
20 - 24	174	11.7	132	22.0
25 - 29	336	22.6	152	25.3
30 - 34	286	19.3	98	16.3
35 - 39	235	15.9	45	7.5
40 - 44	197	13.3	42	7.0
45 - 49	136	9.2	30	5.0
50 - 54	66	4.5	23	3.8
55 - 59	30	2.0	—	—
Total	1482	100	600	100

Table 2 MEAN SYSTOLIC AND DIASTOLIC PRESSURES
RURAL SUBJECTS

Age (Years)	MALES						FEMALES					
	No	Systolic		Diastolic		No	Systolic		Diastolic			
		Mean	S.D	Mean	S.D		Mean	S.D	Mean	S.D		
15 - 19	22	113.1	12.6	75.6	10.0	78	110.0	11.2	62.5	11.0		
20 - 24	174	116.2	14.2	77.7	10.0	132	113.4	11.6	64.2	12.0		
25 - 29	336	119.5	17.0	77.7	10.8	152	115.0	14.2	64.5	12.6		
30 - 34	286	120.6	18.6	78.4	12.1	98	120.1	18.2	74.9	12.4		
35 - 39	235	121.9	18.7	81.3	12.0	45	120.0	20.2	76.1	14.1		
40 - 44	197	128.4	20.0	83.1	12.0	42	126.5	22.4	77.2	14.2		
45 - 49	136	135.1	27.4	84.8	12.8	30	127.5	22.5	84.5	14.5		
50 - 54	66	135.2	26.7	84.9	14.2	23	130.5	24.4	88.2	14.2		
55 - 59	30	141.3	30.9	85.2	11.6	-	-	-	-	-		
Total	1482	125.7	20.7	81.0	11.7	600	120.5	18.1	74.0	13.1		

Table 3

MEAN SYSTOLIC AND DIASTOLIC PRESSURES - RURAL MALES

Age (Years)	RURAL CLERKS				RURAL LABOURERS					
	No	Systolic		Diastolic		No	Systolic		Diastolic	
		Mean	S.D	Mean	S.D		Mean	S.D	Mean	S.D
15 - 19	10	114.0	8.0	80.0	7.4	12	112.5	15.3	75.8	11.1
20 - 24	87	116.8	9.4	75.9	9.6	87	115.5	14.6	76.1	7.9
25 - 29	115	119.5	15.7	77.9	10.3	221	119.5	17.6	77.7	11.1
30 - 34	59	121.0	19.5	79.5	15.6	227	120.5	18.4	78.2	11.0
35 - 39	44	125.5	18.6	82.3	11.4	191	121.1	18.6	80.3	13.9
40 - 44	40	129.8	17.7	85.0	11.4	157	128.2	20.6	82.6	12.1
45 - 49	20	135.5	22.7	89.5	12.4	116	135.0	28.1	84.0	12.7
50 - 54	7	142.9	21.9	92.9	13.9	59	132.0	26.9	83.9	13.9
55 - 59	5	144.0	20.6	88.0	13.1	25	140.8	32.6	84.6	11.2
Total	387	127.7	17.1	83.4	11.6	1095	124.9	21.4	80.3	11.7

TABLE 4

NUMBER OF HYPERTENSIVES FOUND AT PRIMARY
AND SECONDARY SCREENING IN ISIUWA VILLAGE
(1976)

Sex	Number screened	Number of hypertensives found	
		Primary	Secondary
Male	1482	105 (7.1%)	41 (2.8%)
Female	600	18 (3.0%)	3 (0.5%)
Total	2082	123 (5.9%)	44 (2.1%)

Table 5AGE AND SEX DISTRIBUTION OF (URBAN)SUBJECTS SCREENED IN THE CITY

Age (Years)	Males		Females	
	No	%	No	%
15 - 19	26	2.8	32	9.2
20 - 24	173	18.9	109	31.4
25 - 29	190	20.7	105	30.3
30 - 34	193	21.1	63	18.2
35 - 39	120	13.1	23	6.6
40 - 44	110	12.0	10	2.8
45 - 49	62	6.8	5	1.5
50 - 54	37	4.0	-	-
55 - 59	5	0.6	-	-
Total	916	100	347	100

Table 6 MEAN SYSTOLIC AND DIASTOLIC PRESSURES
URBAN SUBJECTS

Age (Years)	MALES				FEMALES					
	No	Systolic		Diastolic		No	Systolic		Diastolic	
		Mean	S.D	Mean	S.D		Mean	S.D	Mean	S.D
15 - 19	26	120.8	17.4	77.3	9.4	32	107.5	13.5	72.8	9.1
20 - 24	173	119.7	13.6	77.2	10.9	109	110.8	13.2	71.7	13.5
25 - 29	190	122.7	18.7	79.5	11.0	105	113.1	15.7	72.5	11.4
30 - 34	193	123.4	19.0	80.0	12.9	63	118.1	16.9	78.7	12.7
35 - 39	120	129.5	22.7	83.4	12.3	23	123.5	19.0	80.4	12.7
40 - 44	110	133.6	19.8	86.9	13.0	10	133.0	30.3	83.0	16.8
45 - 49	62	140.8	26.8	91.2	13.9	5	155.0	33.5	97.5	16.4
50 - 54	37	140.7	23.3	87.0	11.4	-	-	-	-	-
55 - 59	5	140.0	22.4	90.0	14.1	-	-	-	-	-
Total	916	130.1	20.4	83.6	12.1	347	123.0	20.3	79.5	13.2

Table 7 Two-sample t-test statistics for comparing
mean blood pressure in different samples

Age	Males Rural v Urban		Females Rural v Urban	
	Systolic	Diastolic	Systolic	Diastolic
15 - 19	-1.73	-0.50	1.00	-4.69 ***
20 - 24	-2.34*	-0.45	1.63	-4.56 ***
25 - 29	-2.00*	-1.82	1.01	-5.20 ***
30 - 34	-1.60	-1.38	0.70	-1.88
35 - 39	-3.36***	-1.55	-0.69	-1.22
40 - 44	-2.19	-2.58**	-0.77	-1.12
45 - 49	-1.37	-3.18**	-2.36*	-1.83
50 - 54	-1.05	-0.77	-	-
55 - 59	0.09	-0.83	-	-

Statistical significance indicated by

* (P < .05)

** (P < .01)

*** (P < .001)

Table 8 ELECTROCARDIOGRAPHIC CRITERIA FOR
LEFT VENTRICULAR HYPERTROPHY*

(i)	RV_5	$>$	26 mm
(ii)	R in I, II, III	$>$	20 mm
(iii)	R in AVL	$>$	12 mm
(iv)	$SV_1 + RV_5$	$>$	35 mm

* Any one criterion out of the four
criteria was accepted as evidence of
left ventricular hypertrophy.

Table 9 AGE AND SEX DISTRIBUTION OF
150 HYPERTENSIVE SUBJECTS

Age group (Years)	MALES		FEMALES	
	No	%	No	%
15 - 19	-		-	-
20 - 24	-		-	-
25 - 29	1	0.8	-	-
30 - 34	3	2.4	1	4.0
35 - 39	9	7.2	5	20.0
40 - 44	15	12.0	12	48.0
45 - 49	38	30.4	7	28.0
50 - 54	42	33.6	-	-
55 - 59	17	13.6	-	-
Total	125	100	25	100

Table 10 AETIOLOGY OF HYPERTENSION

Aetiology	Male	%	Female	%
Essential hypertension	121	96.8	23	92.0
Renal hypertension	3	2.4	1	4
Gross Obesity	-	-	1	4
Coarctation of Aorta	1	0.8	-	-
Total	125	100	25	100

Table 11: DEFAULT RATE FROM HYPERTENSION CLINIC

No of Subjects treated	150
No defaulting within first 3 months	45 (30%)
No defaulting between 3 - 6 months	20 (13.3%)
Total No defaulting by end of 1st year	74 (49.3%)

Table 12 REASONS FOR DEFAULTING FROM
HYPERTENSION CLINIC

Didn't attend because of lack of Symptoms	24 (40%)
High cost of consultation fees and drug bills	15 (25%)
Felt better	7 (11.7%)
Unpleasant side effects	6 (10%)
Resort to traditional healers	8 (13.3%)
Total No interviewed	60

Appendix 2RURAL BLOOD PRESSURE SURVEY

Please fill this form in Block Capitals.

Ring the appropriate work where necessary

e.g. Sex F M

- | | | |
|----|-------------------------------|---------|
| 1. | Name | 1 - 20 |
| 2. | Department Indicator | 21 |
| | 1. Senior office worker | |
| | 2. Intermediate office worker | |
| | 3. Junior office worker | |
| | 4. Labourer Field worker | |
| | 5. Technician Field worker | |
| 3. | Address
..... | 22 - 41 |
| 4. | Tribe Indicator | 42 - 43 |
| | 1. Edo | |
| | 2. Itsekiri | |
| | 3. Urhobo | |
| | 4. Yoruba | |
| | 5. Ibo | |
| | 6. Efik | |
| | 7. Ibibio | |
| | 8. Hausa | |
| | 9. Others | |
| 5. | Age | 44 - 46 |
| 6. | Sex M F | 47 |

7.	Weight	kg	48 - 52
8.	Height	cm	53 - 55
9.	Skin-Fold Thickness		56 - 58
10.	Number of Children (For Women only)		59
	1. Alive		
	2. Dead		
11.	Marital Status		60
	1. Single		
	2. Married		
	3. Seperated		
	4. Widow(er)		
12.	Educational Level		61
	1. University		
	2. Technical		
	3. Teacher		
	4. Secondary		
	5. Middle		
	6. Primary		
	7. None		
13.	Blood Pressure		62 - 68
14.	Pulse Minute		69 - 71
15.	Observer		72
	1.		
	2.		
	3.		

16. Urine

73

1. Albumen nil
2. Trace
3. +
4. ++ or more
5. Sugar +
6. Sugar and albumin +
7. Could not pass

Blank

74 - 80

APPENDIX 3URBAN BLOOD PRESSURE SURVEY

Please fill this form in Block Capitals.

Ring the appropriate word where necessary.

e.g. Sex F M

- | | | |
|-----|--|---------|
| 1. | Name | 0 - 25 |
| 2. | Grade in Office | 26 |
| | 1. Senior Office Worker | |
| | 2. Intermediate Office Worker | |
| | 3. Junior Office Worker | |
| | 4. Others | |
| 3. | Address - Ministry | 27 - 46 |
| | Department or Section | 47 - 48 |
| 4. | Duration of residence in Benin City. | |
| | How long have you lived in Benin City? | |
| |years | 49 |
| | 1. 0 - 4 years | |
| | 2. 5 - 9 years | |
| | 3. 10 or more years | |
| 5. | Age | 50 - 51 |
| 6. | Sex F M | 52 |
| 7. | Weightkg. | 53 - 57 |
| 8. | HeightCm | 58 - 60 |
| 9. | Skin - Fold Thickness | 61 - 63 |
| 10. | Marital Status. | |

10.	Marital Status	64
1.	Single	
2.	Married	
3.	Separated	
4.	Widow (er)	
11.	Educational Level	65
1.	University	
2.	Technical	
3.	Teacher	
4.	Secondary	
5.	Middle	
6.	Primary	
7.	None	
12.	Blood Pressure	66 - 71
13.	Pulse Minute	72 - 74
14.	Observer	75
1.		
2.		
3.		
15.	Urine	76 - 80
1.	Albumen nil	
2.	Trace	
3.	+	
4.	++ or more	
5.	Sugar +	
6.	Sugar and Albumen	
7.	Could not pass.	

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ARTERIAL BLOOD PRESSURES AND HYPERTENSION IN A RURAL NIGERIAN COMMUNITY

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Summary

In 1976 a blood pressure survey was conducted in Isiuwa village to determine the prevalence of hypertension in a rural Nigerian Community and the effect of re-examination of those subjects who were found to be 'hypertensive' at the primary screening. Out of the 2082 subjects aged 15 to 59 years examined at the primary screening, 123 (5.9%) were found to be hypertensive and when these 123 hypertensive subjects were re-examined 8 to 12 weeks later, only 44 (2.1%) subjects remained hypertensive. The phenomenon responsible for the reduction in yield of hypertensives is thought to be a real one in studies of apparently healthy populations. This phenomenon does not, however, diminish the prognostic significance of a casual elevation of blood pressure.

The prevalence of hypertension is low in the community studied and some factors which may favourably affect blood pressures are discussed.

The low prevalence of hypertension among the highly parous women in this community is similar to that found in a study among some rural Ghanaians but different to studies among some rural communities in Nigeria.

Résumé

En 1976 une enquête sur la tension artérielle a été faite dans le village d'Isuwa pour déterminer la fréquence de l'hypertension dans une communauté rurale en pleine transition et pour déterminer le résultat d'une nouvelle

visite médicale de ceux que l'on avait jugés 'hypertendus' à la première visite. Sur les 2082 personnes âgées de 15 à 59 ans examinées pendant la première visite, 123 (soit 5.9%) se sont révélées hypertendues et lorsque ces 123 personnes hypertendues ont été examinées de nouveau, 8 à 12 semaines plus tard, il n'y avait que 44 (soit 2.1%) personnes qui sont restées hypertendues. La réalité du phénomène responsable de la réduction du pourcentage ne fait aucun doute quand on étudie des populations apparemment en bonne santé. Ce phénomène ne diminue pas, cependant, l'importance pronostique d'une élévation accidentelle de la tension artérielle.

La fréquence de l'hypertension est faible dans la communauté étudiée et les raisons possibles de cette découverte sont données dans le texte. Nous avons aussi constaté que le niveau de la tension artérielle était sans rapport avec la parité lorsqu'on contrôle l'âge du patient; cette découverte est semblable à celle d'une étude faite sur certains Ghanaiens de la campagne mais différente de celle d'une étude précédente sur certaines communautés rurales du Nigéria.

Introduction

There have been several reports on blood pressure studies in African communities. In some communities arterial blood pressure rises with increasing age (Abrahams, Alele & Barnard, 1960; Scotch, 1961; Shaper & Saxton, 1969; Parry, 1969; Johnson, 1971; Akinkugbe, 1972; Oyediran *et al.*, 1976), whilst in some other communities the blood pressure does not rise with increasing age (Williams, 1941; Kaminer & Lutz, 1960; Shaper, 1972; Etta & Watson, 1976).

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Hypertension is not a significant health problem in rural Ghanaians (Pobee *et al.*, 1977). All these studies with the exception of the one by Oyediran *et al.* (1976) have been the results of a single screening.

Although there have been a number of reports from Nigeria on community studies of arterial blood pressure, no reports of any community study of arterial blood pressure and hypertension have emanated from the Bendel State of Nigeria. This paper reports some findings in screening a rural Nigerian community in the Bendel State for hypertension and the effect of re-examination of the subjects found to be hypertensive at the initial examination after an interval of between 8 and 12 weeks.

Materials and methods

Population studied

Isiuwa village, a conglomeration of what were originally three smaller villages, is situated 30 kilometers north-west of Benin City. It occupies 1735 hectares of rolling countryside, of which 122 hectares consist of the residential village whilst the remaining land is devoted to the growing of oil palm, coconut and raphia palms.

The population of Isiuwa village is about 5000 (private census, 1976). The ethnic groups residing in the village include several tribes (Edo, 59%; Ibo, 18%; Ibibio, 10%; Urhobo, 9%; Yoruba, 2%; and others, 2%).

The head of every household at Isiuwa village is employed at the Nigerian Institute for Oil Palm Research (NIFOR). NIFOR has overall responsibility for the administration and welfare of Isiuwa village. NIFOR is also responsible for the development of the extensive palm plantation at Isiuwa village. The main product is palm oil.

Apart from working for NIFOR most of the adult males in Isiuwa village are also engaged in part-time farming (chiefly of maize, yams, cassava and vegetables). The women in Isiuwa village are mostly employed in subsistence farming and 'petty trading'. There is a high fertility rate and by the end of the reproductive period an average woman has gone through as many as ten pregnancies.

Minor health services for the residents are provided at the Health Centre in the village by two nursing sisters, assisted by midwives.

Methods

A check on the current staff list of NIFOR and the wages roll, and canvassing among the married males to permit their wives to attend for examination, identified 1500 men and 750 women between the ages of 15 and 60 years who were eligible for and capable of attending the screening examination.

During the months of June and July 1976, 1482 (98.8%) males and 600 (80%) females attended the examination.

The male subjects were invited in small groups to attend at a temporary examination centre situated as close as possible to their place of work. The female subjects were examined in the community hall in the centre of Isiuwa village. Four female assistants using a standard questionnaire obtained information from the respondents about age, sex, marital and educational status, occupation and in the case of women, parity.

Measurement was made of heights and weights. Urine samples from all the respondents were examined for protein and sugar using Uristrix strips (Ames).

The blood pressures of all the respondents were measured by the author. These were recorded while the subjects were seated after resting for 5 minutes. A standard mercury sphygmomanometer with a cuff size of 12 X 22 cm was used. All measurements were taken in the left arm between 09.00 and 13.00 hours. The systolic blood pressure was taken at the first appearance of the sound whilst the diastolic blood pressure was taken at the point where there was an abrupt muffling of sound (Phase 4).

Subjects with systolic blood pressures of 160 mmHg and over or a diastolic blood pressure of 100 mmHg and above, or a combination of both, were recalled for secondary screening examination in the same location between 09.00 and 13.00 hours within a minimum period of 8 weeks and a maximum period of 12 weeks. All the subjects with blood pressures sustained at the levels described above were referred to a special clinic at the University of Benin Teaching Hospital.

Results

Distribution of mean blood pressure by age and sex

Table 1 shows the age and sex distribution of the 2082 subjects (1482 males and 600 females) examined.

TABLE 1. Age and sex distribution of subjects screened

Age group (years)	Males		Females	
	Number	%	Number	%
15-19	22	1.5	78	13.0
20-24	174	11.7	132	22.0
25-29	336	22.6	152	25.3
30-34	286	19.3	98	16.3
35-39	235	15.9	45	7.5
40-44	197	13.3	42	7.0
45-49	136	9.2	30	5.0
50-54	66	4.5	23	3.8
55-59	30	2.0	—	—
Total	1482	100	600	100

systolic and diastolic pressures with increasing age. In the case of females, whilst there is a gradual rise of mean systolic pressure with age, the rise in mean diastolic pressures appeared to have been marked from the age of 25 to 30 years, and again from the age of 40 to 45 years.

The mean systolic and diastolic blood pressures in young men tend to be slightly higher than those of young women. In the case of older age groups mean diastolic pressures of women at the age of 45 years is higher than that for men.

Prevalence of hypertension

To allow for comparison of the results here with those of some known workers researching in community studies of blood pressures using identical methods in different parts of West Africa, identical criteria for hypertension have been adopted. Hypertension is defined as a systolic blood pressure of 160 mmHg and above or a diastolic blood pressure of 100 mmHg and above or a combination of both.

Fig. 3 shows the distribution of 'hypertensive' subjects by age and sex as found at the primary screening. There is a gradual increase in the number of hypertensive subjects with increasing age. Except in the age group 35-39 years, where the number of female hypertensives was found to be more than the number of male hypertensives, and the age group 45-49 years, where both male and female hypertensives were equal, there were more male hypertensives than female hypertensives

Fig. 1 shows that in the community studied there was no evidence of a bimodal distribution of subjects with and without hypertension.

Tables 2 and 3 show the frequency distribution of the systolic and diastolic blood pressures respectively of all 2082 subjects examined as found at the first screening examination.

Fig. 2 shows the trend of systolic and diastolic pressures with age. In the case of males there is a gradual rise of the mean

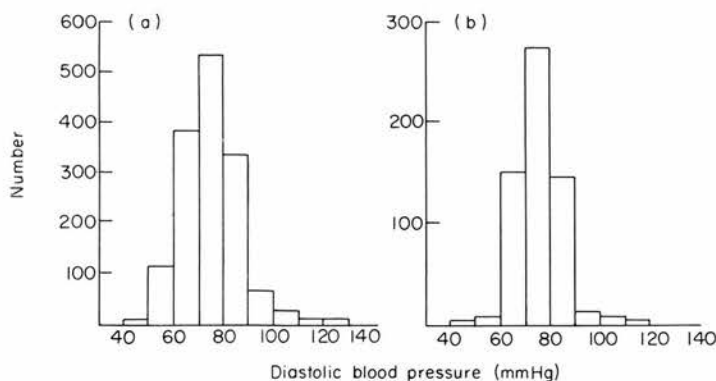


FIG. 1. The distribution of diastolic blood pressure in Isiuwa village (1976). (a) Males; (b) females.

TABLE 2. Distribution of systolic blood pressure in Isiuwa village (1976)

Age	Sex	Number	Mean	s.d.	< 140 mmHg	140-49 mmHg	150-59 mmHg	160-69 mmHg	170 + mmHg
15-19	M	22	113.1	12.6	21	1	0	0	0
	F	78	110.0	11.2	77	0	1	0	0
20-24	M	174	116.2	14.2	158	11	4	1	0
	F	132	113.4	11.6	128	2	2	0	0
25-29	M	336	119.5	17.0	277	40	8	6	5
	F	152	115.0	14.2	151	1	0	0	0
30-34	M	286	120.6	18.6	235	30	9	5	7
	F	98	120.1	18.2	93	2	1	2	0
35-39	M	235	121.9	18.7	182	25	18	4	6
	F	45	120.0	20.2	40	2	1	2	0
40-44	M	197	128.4	20.0	131	31	15	11	9
	F	42	126.5	22.4	33	2	3	2	2
45-49	M	136	135.1	27.4	83	15	16	11	11
	F	30	127.5	22.5	23	2	3	2	0
50-54	M	66	135.2	26.7	40	6	9	3	8
	F	23	130.5	24.4	14	3	2	2	2
55-59	M	30	141.3	30.9	14	5	0	4	7
	F	—	—	—	—	—	—	—	—
Total	M	1482	125.7	20.7	1141	164	79	45	53
	F	600	120.5	18.1	559	14	13	10	4

TABLE 3. Distribution of diastolic blood pressure in Isiuwa village (1976)

Age	Sex	Number	Mean	s.d.	< 90 mmHg	90-99 mmHg	100-109 mmHg	110 + mmHg
15-19	M	22	75.9	10.0	22	0	0	0
	F	78	62.5	11.0	64	14	0	0
20-24	M	174	77.7	10.0	145	27	1	1
	F	132	64.2	12.0	111	21	0	0
25-29	M	336	77.7	10.8	252	74	6	4
	F	152	64.5	12.6	122	30	0	0
30-34	M	286	78.4	12.1	217	51	14	4
	F	98	74.9	12.4	79	16	2	1
35-39	M	235	83.9	12.0	172	48	11	4
	F	45	76.1	14.1	27	14	2	2
40-44	M	197	83.1	12.0	113	60	19	5
	F	42	77.2	14.2	24	16	2	1
45-49	M	136	84.8	12.8	77	40	9	10
	F	30	84.5	14.5	7	18	3	2
50-54	M	66	84.9	14.2	40	13	6	7
	F	23	88.2	14.2	3	17	2	1
55-59	M	30	85.2	11.6	13	13	2	2
	F	—	—	—	—	—	—	—
Total	M	1482	81.3	11.7	1051	326	68	37
	F	600	74.0	13.1	437	145	11	7

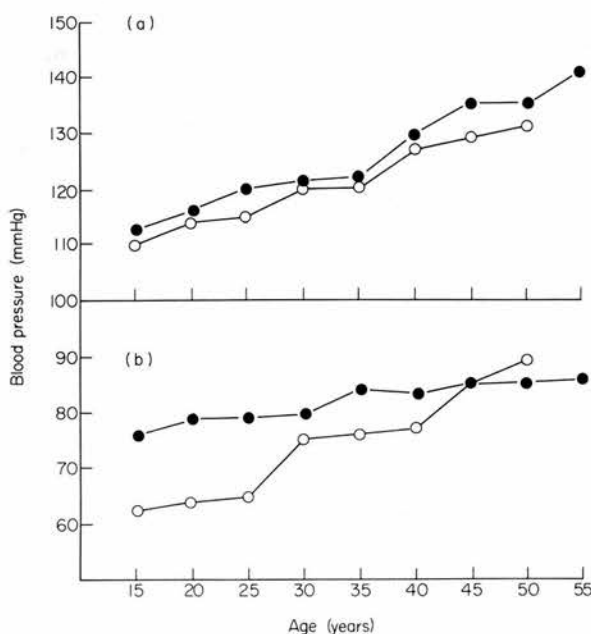


FIG. 2. Distribution of mean blood pressure by age and sex in Isiuwa village (1976). (a) Systolic; (b) diastolic; (●) male; (○) female.

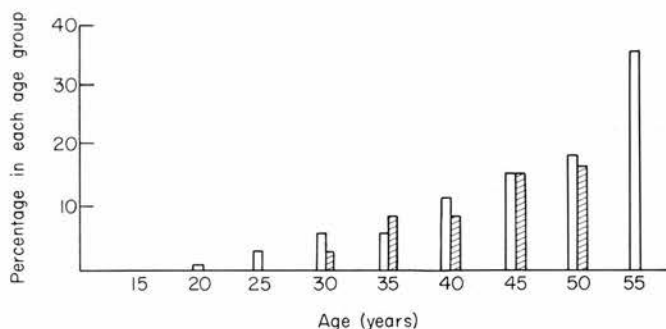


FIG. 3. Distribution of hypertensive subjects by age and sex in Isiuwa village (1976). (□) Male; (▨) female.

in the other age groups, beginning from the 20-24 year age group. There were no male hypertensives in the 15-19 year age group and no female hypertensives were detected from the age of 15 years to the age of 29 years.

A total of 123 subjects (5.9 of those initially screened), made up of 105 males and eighteen females, were found to be hypertensive after the primary screening. Out of the 123 subjects found to be hypertensive at the primary screening only forty-four were found to remain hypertensive at the second

examination. The number of hypertensives as found at both the primary and secondary examination is summarized in Table 4.

Urinalysis

Three males and one female had glycosuria. Diabetes mellitus was ultimately confirmed in two of the males and in the only female.

The numbers of subjects who had proteinuria at the primary screening were seventy-nine (5.3%) males and thirty-six (6.0%)

females. Among the forty-four who remained hypertensive at the second examination, only one of them had proteinuria.

TABLE 4. Number of hypertensives found at primary and secondary screening in Isiuwa village (1976)

Sex	Number screened	Number of hypertensives found	
		Primary	Secondary
Male	1482	105 (7.1%)	41 (2.8%)
Female	600	18 (3.0%)	3 (0.5%)
Total	2082	123 (5.9%)	44 (2.1%)

Discussion

The present study has demonstrated that re-examination of the subjects found to be hypertensive at the primary screening significantly affects the prevalence of hypertension in an African community. At the cut-off points of 160 mmHg systolic or 100 mmHg diastolic a yield of 123 (5.9%) hypertensives after primary screening was reduced to 44 (2.1%) at secondary screening after an interval of between 8 and 12 weeks following the primary screening.

Armitage & Rose (1966) have shown that misclassification of subjects can be considerably reduced, for both systolic and diastolic pressure measurements, by re-examination of subjects. Re-examination of subjects increases the precision of the blood pressure estimation very greatly.

That secondary screening can substantially reduce the yield of hypertensives after primary screening has been confirmed among some communities in Scotland. Hawthorne, Greaves & Beevers (1974), in Renfrew, found that at a cut-off point of 100 mmHg diastolic a yield of 467 (15.8%) hypertensives after primary screening was reduced to 243 (8.0%) at secondary screening after an interval of between 8 and 12 weeks. Similar reduction was also achieved in Paisley in the same interval by the same team. Hawthorne *et al.* (1974) thought that the phenomenon responsible for the reduction in yield, despite the use of standardized techniques (Rose, Holland & Crawley, 1964; Rose, 1965), might be a real one in studies of apparently healthy populations.

This phenomenon does not, however, diminish the prognostic significance of a casual elevation of blood pressure.

The population of hypertension is low in the rural adults in this study. Table 4 shows that the 5.9% of all the survey subjects were found to be hypertensive at the primary screening but ultimately only 2.1% of all the survey subjects were referred to the clinic at the secondary screening. This study and others (Akinkugbe & Ojo, 1969; Parry, 1975; Pobe *et al.*, 1977) have confirmed that the prevalence of hypertension is low among people in rural communities.

Increased physical activity from working in plantations and farms may favourably affect the blood pressure of the subjects. Most of the subjects examined walk or ride push bicycles long distances to the plantations and farms where their tasks involve strenuous physical activity, clearing, planting and harvesting by hand. Their diet consists mainly of the traditional high carbohydrate and very low protein. Relaxation in the evenings consists of sitting in the open air and listening to stories. The hustle and bustle characteristic of city life is absent at Isiuwa village. Extended house holds that are typical of the more isolated rural communities appear to be less common in the community studied.

The distribution of the diastolic blood pressure of the subjects shown in Fig. 1 does not indicate a bimodal distribution of subjects with and without hypertension. Pickering (1968) produced evidence of a bimodal distribution of subjects with and without hypertension. The finding in this study of a gradual rise of blood pressure with age is similar to the level and slope of blood pressures found in other rural African societies (Parry, 1975; Pobe *et al.*, 1977).

Soyanwo *et al.* (1975), in an examination of the relationship of sex and parity to systemic hypertension in the negro, found that high blood pressure was more common among females than males and suggested that parity bore some significant relationship to the trend. Pobe *et al.* (1977), however, in their study among rural Ghanaians, found that after the age of 35 years women were more likely to be hypertensive than men, although the sex differential was not marked. They found no relationship between the

level of blood pressure and parity. In spite of the high parity recorded among the women examined in this study, the prevalence of hypertension is low, accounting for 3.0% at the primary examination and finally 0.3% at the secondary examination. It has, however, been shown in the U.S.A. that the contribution of parity to blood pressure is generally due to the concurrent rise in age and weight with increasing parity (National Centre for Health Statistics, 1972).

The high parity among the women studied might be expected to predispose them to the risk of acquiring pyelonephritis and consequent hypertension. The prevalence of pyelonephritis among the subjects in this study is not known, but 5.3% of the males and 6.0% of the females had proteinuria at the primary screening. However, only one out of the forty-four subjects who remained hypertensive at the second examination had proteinuria. It is hoped that further investigations and follow-up of the forty-four subjects who have been referred to hospital would elucidate the type of hypertension found in these rural Nigerians.

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Occupational factors in hypertension in the Nigerian African

BY

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Occupational factors in hypertension in the Nigerian African

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SUMMARY In cross-sectional surveys of arterial blood pressure carried out in rural and urban communities in the Bendel State of Nigeria, mean systolic and diastolic pressure was generally higher in urban than in rural subjects but the differences in particular age groups were statistically significant only in some of them. Two sample Student's *t* tests were carried out to compare the blood pressure of rural labourers, rural clerks, and urban clerks. It is not clear from our findings whether the differences in any *particular* age group between rural labourers and urban clerks should be attributed to occupation or to area of residence. However, the consistently intermediate values for rural clerks over the *different* age groups provide strong indirect evidence that both these factors are relevant.

Many reports have shown that the arterial blood pressure of the urban African is generally higher than that of his rural counterpart (Scotch, 1960; Scotch *et al.*, 1961; Akinkugbe and Ojo, 1969; Pobee *et al.*, 1977). Although many factors are known that could modify blood pressure, no reasons based on comparative studies have been produced to explain the difference in pressure between the urban and rural African. The possible influence of occupations with different degrees of physical activities has not been examined. With this omission in mind, an attempt has been made to measure the blood pressure of a group of African field labourers and office clerks, in the hope that differences in occupation might explain in part the differences in blood pressure.

Methods

Two populations in the Bendel State of Nigeria were defined—one rural, the other urban—and the study was carried out in two stages.

SUBJECTS

Rural Study

Isiwa village, a conglomeration of what were originally three smaller villages, is situated 36 km north-west of Benin City.

The village occupies 1735 hectares of rolling countryside in the equatorial forest zone of Bendel State. The residential village is spread over 122 hectares of land and the remaining land is devoted to the growing of oil palm, coconut, and raphia palms. The population of Isiwa village is about 5000 (private census, 1976). The head of every household is employed at the Nigerian Institute for Oil Palm Research (NIFOR). NIFOR has overall responsibility for the administration and welfare of Isiwa village. NIFOR is also responsible for the cultivation of oil palms and the production of oil from the extensive palm plantation at the village.

Of the total of 1500 male adults aged 15 to 60 resident in the village, 400 men work in the offices of NIFOR and 1100 men work as field labourers. Of the field labourers, 330 men (30%) were literate, judged by ability to read and write. Most of the 750 adult women who were in Isiwa village at the time of the survey were engaged in subsistence farming and 'petty trading'.

During the months of June and July 1976, 1482 men and 600 women were examined.

Urban Study

Benin City with a population of about 200 000 (government census, 1963) is the capital city of Bendel State of Nigeria. The study was concerned

with the clerical workforce of the state capital's secretariat. The secretariat is situated in the centre of the city and houses 12 government Ministries (departments). At the time of the survey 970 males and 360 females aged between 15 and 60 were employed in the secretariat; 179 males (18.5%) and 34 females (9.4%) work as senior administrative staff by being at the head of the various subunits staffed by junior clerical workers. During the months of September, October, and November, 1977, 916 males and 347 females were examined.

In both the rural and the urban surveys blood pressure readings were taken using a standard mercury sphygmomanometer with a cuff size of 12 x 22 cm. All measurements were taken in the left arm between 09.00 and 13.00 hours, after the subjects had been seated for five minutes. The systolic blood pressure (SBP) was taken at the first appearance of sound. The diastolic blood pressure (DBP) was taken at the point when there was an abrupt muffling of sound (phase 4).

Using a standard questionnaire, information was obtained from the respondents about name, address, age, sex, occupation, marital and educational status, and position held at work. To confirm the accuracy of statements about age, especially in doubtful cases, the respondents were encouraged to relate their age to local historical records, such as dates of traditional festivities, missionary activities, national events, and the coronation of local kings. The general appearance of the subjects was sometimes relied on; and in the case of illiterate women, the years of marriage, the ages of their firstborn, and the onset of menopause helped to verify age. It was considered futile to attempt to estimate age more accurately than by five-year groups. The height and weight of all respondents was measured without shoes and with light clothing. Quetelet's index of body mass was calculated for each subject as $\text{weight (kg)}/\text{height}^2 (\text{cm}) \times 100$ (Khosla and Lowe, 1967). All respondents were asked about their smoking habits.

Urine samples from all the respondents were examined for protein and sugar using uristix strips (Ames).

For this study hypertension was defined as SBP of 160 mm Hg and above, or DBP of 100 mm Hg and above, or a combination of both. Subjects with blood pressure below these given levels were considered normotensive.

Results

Response rates

In the rural survey 387 male office clerks and 1095 male field labourers were examined, giving response rates of 96.8% and 99.5% respectively. The number

of women examined in the rural survey was 600, giving a response rate of 80%.

In the urban survey 916 males and 347 females were examined, giving response rates of 94.4% and 96.4% respectively.

Mean arterial pressures

Mean SBP and DBP for the entire rural and urban populations is expressed graphically in Fig. 1 (rural and urban males) and Fig. 2 (rural and urban females). It can be seen that, for both males and females, mean arterial blood pressure for the urban populations was generally higher than for the rural populations.

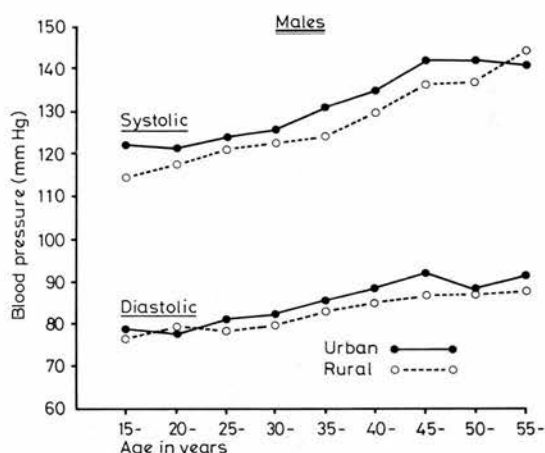


Fig. 1 Mean systolic and diastolic blood pressure of urban and rural males.

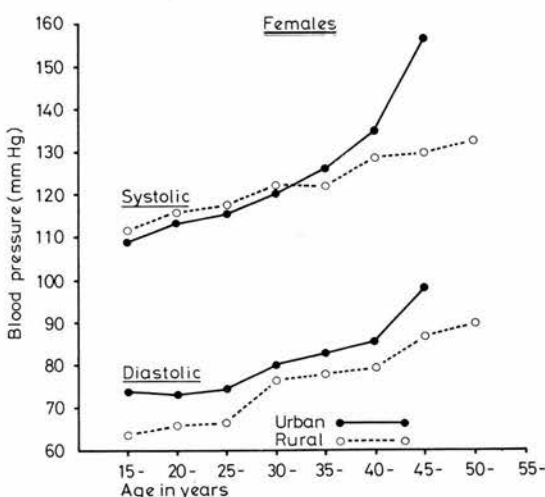


Fig. 2 Mean systolic and diastolic blood pressure of urban and rural females.

The statistical significance of the differences in mean blood pressure between the rural and urban populations is expressed in Table 1.

Table 2 shows the mean SBP and DBP with their standard deviations (SD) of rural clerks and rural labourers and Fig. 3 shows the mean values of the SBP and DBP of rural clerks, rural labourers, and urban clerks. It can be seen that rural clerks had higher SBP and DBP than rural labourers, and that urban clerks had higher SBP and DBP than rural clerks.

Two sample Student's *t* tests were carried out to compare the mean blood pressure of rural clerks with that of rural labourers and also the mean blood pressure of rural clerks with that of urban clerks. None of the comparisons was significant.

Quetelet's index and blood pressure

Fig. 4 shows that as SBP increased with age the Quetelet indices also increased with age in rural clerks and only slightly in rural labourers. However, the differences in the Quetelet indices in each particular age group were not statistically significant.

Table 1 Two sample Student's *t* test statistics for comparing mean blood pressure in different samples

Age group (years)	MALES		FEMALES	
	Rural v Urban		Rural v Urban	
	Systolic	Diastolic	Systolic	Diastolic
15-19	-1.73	-0.50	1.00	-4.69***
20-24	-2.34*	-0.45	1.63	-4.56***
25-29	-2.00*	-1.82	1.01	-5.20***
30-34	-1.60	-1.38	0.70	-1.88
35-39	-3.36***	-1.55	-0.69	-1.22
40-44	-2.19	-2.58**	-0.77	-1.12
45-49	-1.37	-3.18**	-2.36*	-1.83
50-54	-1.05	-0.77	—	—
55-59	0.09	-0.83	—	—

* (P<0.05)

** (P<0.01)

*** (P<0.001)

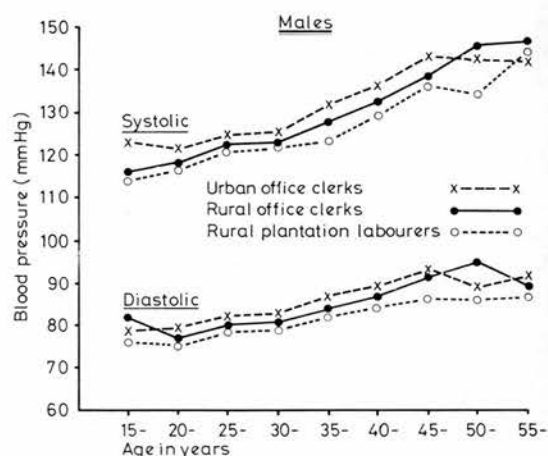


Fig. 3 Mean systolic and diastolic blood pressure of rural clerks, rural labourers, and urban clerks.

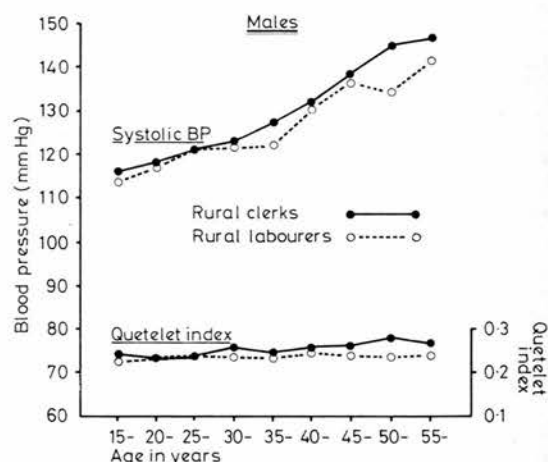


Fig. 4 Relationships between blood pressure and Quetelet indices (rural males).

Table 2 Mean systolic and diastolic blood pressure, rural males

Age group (years)	RURAL CLERKS					RURAL LABOURERS				
	No.	Systolic		Diastolic		No.	Systolic		Diastolic	
		Mean	SD	Mean	SD		Mean	SD	Mean	SD
15-19	10	114.0	8.0	80.0	7.4	12	112.5	15.3	75.8	11.1
20-24	87	116.8	9.4	75.9	9.6	87	115.5	14.6	76.1	7.9
25-29	115	119.5	15.7	77.9	10.3	221	119.5	17.6	77.7	11.1
30-34	59	121.0	19.5	79.5	15.6	227	120.5	18.4	78.2	11.0
35-39	44	125.5	18.6	82.3	11.4	191	121.1	18.6	80.3	13.9
40-44	40	129.8	17.7	85.0	11.4	157	128.2	20.6	82.6	12.1
45-49	20	135.5	22.7	89.5	12.4	116	135.0	28.1	84.0	12.7
50-54	7	142.9	21.9	92.9	13.9	59	132.0	26.9	83.9	13.9
55-59	5	144.0	20.6	88.0	13.1	25	140.8	32.6	84.6	11.2
Total	387	127.7	17.1	83.4	11.6	1095	124.9	21.4	80.3	11.6

A rise in blood pressure and in the Quetelet indices with age was also found in both male and female urban subjects.

Blood pressure of literate and illiterate labourers

Mean SBP and DBP were calculated for 30 literate labourers sampled from each of the age groups 35–39 and 40–44 and compared with a similar number of illiterate labourers from the same age groups. No significant differences in mean pressure were found.

Urinalysis

Among the rural subjects, 79 males (5.3%) and 36 females (6.0%) had proteinuria. Among the urban subjects, 98 males (10.7%) and 28 females (8.1%) had proteinuria. Among the subjects with proteinuria, the finding of pus cells and/or hyaline casts on microscopic examination of their urine suggested renal disease related to high blood pressure in only one male in the rural community and three subjects (two males and one female) in the urban community.

Smoking and blood pressure

Eight males (2%) among the rural clerks and 12 males (1.1%) among the rural labourers smoked between five and 10 cigarettes daily. In the urban survey 27 males (2.5%) smoked between five and 10 cigarettes daily. The habit of smoking was not encountered in any of the rural and urban females.

The small number of smokers encountered in this study were all normotensive.

Discussion

High blood pressure is considered to be the result of environmental influences acting over time on the genetically predisposed individual (Pickering, 1967). The rural and urban communities studied here provided an ideal location for studying occupational factors because hypertension is very prevalent in the Nigerian African.

In this study our findings confirmed that the mean SBP and DBP of urban subjects was generally higher than that of rural subjects in comparable age groups but the differences were only statistically significant in the age groups 35–49 in males. For females the differences in DBP were statistically significant in the age groups 13–29. Previous reports (Scotch, 1960; Scotch *et al.*, 1961; Akinkugbe and Ojo, 1969; and Pobe *et al.*, 1977) have been silent on the issue of statistical significance of the differences in the mean arterial pressure found between rural and urban subjects. It is, however, not known whether the difference is due to occupation or to environment.

This study has clearly shown the consistently higher mean arterial pressure of one occupational group over the other, even where both occupational groups share a common environment. Rural office clerks had higher mean arterial pressure than rural field labourers and urban office clerks had higher mean arterial pressure than rural clerks (Fig. 3).

Our findings of higher blood pressure in rural male clerks than in rural male labourers bear apparent similarities to those of Miall (1959) who found that arterial pressure was significantly higher in men previously employed mainly in light occupations than in those in heavy occupations. Miall claimed support for his findings from the occupational mortality supplement of the Registrar General (1958) where it was reported that standardised mortality ratios for hypertension, vascular lesions of the central nervous system, and coronary disease were greatly increased in the light occupation groups.

Morris and Crawford (1958) have suggested a relationship between physical activity, hypertension, and ischaemic heart disease. In their analysis of a national necropsy survey they found that hypertension, based on clinical and pathological findings, was less common and occurred 10 to 15 years later in men previously employed in heavy occupations than in others.

Quetelet's index was chosen as an index of body mass based on a review of population weight for height because it was considered as the least correlated with height and the most correlated with independent measurements of obesity (Khosla and Lowe, 1967). Our findings showed that subjects with higher blood pressure also had higher Quetelet indices. However, the differences in the Quetelet indices between the rural clerks and labourers were not statistically significant. Although the association of weight with blood pressure has been well documented (Kannel *et al.*, 1967; Miall *et al.*, 1968; Ashley and Kannel, 1974) we are unable to show from our findings that the differences in arterial pressure between rural and urban subjects are due to weight.

The number of subjects in our study who smoked cigarettes was small and the number they smoked (five–10 cigarettes daily) is also small compared with those studied in the reports of Stamler *et al.*, (1975). We do not consider that smoking had any influence on our findings. Stamler *et al.*, in a report based on cross-sectional and prospective epidemiological studies in Chicago, found no positive relationship between cigarette smoking and blood pressure.

The rural clerks and rural labourers studied both share a common environment, drink water from the same stream, and eat predominantly high carbohydrate diets with vegetable oil, some meat,

and fish. No attempt was made to estimate the salt intake of the subjects studied. Dahl and Love (1954; 1957) presented evidence that those who take additional salt with their food at table have higher blood pressure than those who do not.

The occupations of our subjects, however, differ in degrees of physical activities. The clerks are in sedentary occupations while the labourers are physically active clearing, planting, and harvesting palm nuts. The subjects also differ in literacy. All the clerks are literate, but only 30% of the field labourers. Important differences in mean blood pressure might arise when comparing two groups, one literate and one illiterate. Distribution of blood pressure is also known to be influenced by socioeconomic, cultural, and educational factors. However, in this study important differences in mean pressure have not been found between the literate and illiterate labourers sampled from the age groups 35–39 and 40–44 where the numbers of subjects allowed for such comparison. We do not think, therefore, that educational factors could account for the differences in mean pressure between the field labourers and the office clerks.

In conclusion, it is not clear from our findings whether the differences in any particular age groups between rural labourers and urban clerks should be attributed to occupation, or to area of residence. However, the consistently intermediate values for rural clerks over the different age groups provide strong indirect evidence that both these factors are relevant.

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